

The Knowledge Bank at The Ohio State University

Ohio State Engineer

Title: Electricity for Our Rural Population

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Issue Date: 1941-12

Publisher: Ohio State University, College of Engineering

Citation: Ohio State Engineer, vol. 25, no. 2 (December, 1941), 14-16, 21.

URI: <http://hdl.handle.net/1811/35810>

ELECTRICITY for OUR

Phil M. Dunson, E.E. III

A product of the new deal with its many alphabetical agencies, the Rural Electrification Administration, usually shortened to REA, is becoming of particular interest to the engineers of this nation because of its effect upon the electrical industry in general and because of the engineering progress continually accompanying the advancement of its program.

Unlike the NRA, the AAA, the TVA, the OGPU, and the ASCAP, the REA has found favor with the American farmer and with the economist; its purpose is expansion rather than restriction, it stands little chance to be declared unconstitutional, and it even shows promise of benefit to the private utility industry.

Need for the REA

Believing that the nations rural population was entitled to the conveniences made possible by the use of electricity which the urban population has enjoyed for many years, and realizing the farmer's need for electricity in his work, Congress on May 20, 1936 approved the creation and establishment of the REA as embodied in the Rural Electrification Act of 1936.

At the beginning of 1935 approximately 10 American farms in every 100 had central-station electric service, in 14 states less than 4 in every 100 had high-line electric service, and nearly 6,000,000 farms had no access to electricity. By the summer of 1940 more than 1 farm in 4 had high-line service. More than 700 REA projects were operating, over 600 of them energized, the coverage including 45 states. REA-financed systems were serving 568,000 consumers, and by now at least 30,000 more are being served. More than 242,000 miles of line were completed and allotments made for 10,000 miles more.

REA Cooperatives

Although REA makes loans for rural line construction to municipalities, to public power districts, and to private power companies, most of the requests for loans come from groups of rural consumers organized as cooperatives. Roughly 90 percent of REA-financed projects are cooperative.

The cooperative form of business enterprise essentially implies that invested capital, in this case the government's, receives no profits, only interest; that profits go to the members in proportion to their patronage; and that each member gets one vote. Mem-

bership in an REA cooperative entails no financial risk other than that of the small membership fee. The cooperative is incorporated and the stock is non-assessable. The federal government does not grant money to the cooperatives but loans to them at a low interest rate. REA cooperatives enjoy no privileges of tax exemption.

The REA has had three administrators—Morris L. Cooke, John M. Carmody, and Harry Slattery, the current boss. A former Columbus Junior-High-School teacher, Robert B. Craig, was acting administrator during part of 1939.

Some private utilities apparently fear the results of the REA but Nelson L. Smith, chairman of the New Hampshire Public Service Commission, believes that the REA is a "blessing in disguise" to the private utility industry. "The REA program promises to benefit the electric utilities in two ways," says Chairman Smith. "In the first place, it is stimulating rural construction and sales promotion by the utilities, while by example tending to lower their building costs. In the second place, where REA systems build lines in sparsely populated districts the private companies are saved investment in possibly unproductive lines which public pressure might otherwise finally force them to construct."

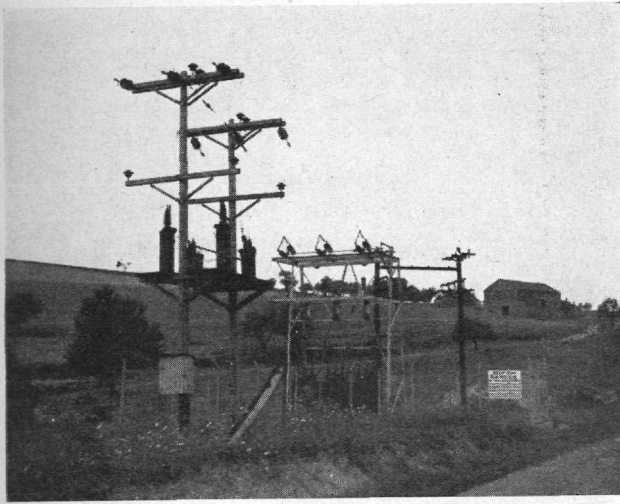
Engineering in REA

Because the task of building lines and supplying power in rural areas had not yet progressed far enough to become a specialization, rural electrification engineering was almost unknown when REA first began to function. Today the special engineering problems encountered in rural distribution systems are more fully understood and standardization of design and of construction methods has set in. Three significant changes in rural line design have led to lower costs in supplying power to the farm: first, the development and use of high-strength conductors; second, the adoption of vertical construction eliminating the use of cross arms on single-phase lines; third, the adoption of the principle of continuous assembly production made possible by the development of large scale construction.

High-Strength Conductors

The use of high-strength conductors has brought with it a steady increase in the length of span between

RURAL POPULATION



Bank of Transformers in Rural Area Courtesy REA

poles. A few years ago a span of 200 feet was usual; today the average span is more than twice this length. Most REA projects use conductors of copper or aluminum, reinforced with steel. Before REA entered the scene these conductors were known, of course, but it took the large-scale demand of the REA projects to induce manufacturers to provide the market with low cost conductors of this type.

Vertical Construction

Great reduction in costs has resulted from standardization of equipment and construction. An obvious money-saving improvement which needed only a little REA pioneering to encourage its widespread use in the vertical construction of single-phase lines with the natural elimination of the cross-arm. The phase wire is carried on a pole top pin and insulator, the neutral is carried on a side bracket. The design had been known for several years but REA was first to use it on a broad scale. Experience with this system led to the four-point construction principle. When it is desired to three-phase a single-phase line, it is necessary only to add a cross arm carrying two or more phase wires. The two original wires are undisturbed, as they are purposely placed far enough apart to permit installation of the separate crossarm assembly, and the neutral serves equally well as part of a three-phase circuit.

Redesigning of the metal bracket supporting the neutral wire has cut upkeep costs. The new bracket

provides for easier tying and eliminates the sharp angle in the wire formerly occurring when ice weighed the line down.

The Assembly Line

Applied to rural line construction, the continuous assembly production or moving belt principle involves dividing a construction crew into small, highly specialized sections and sending these sections along a road in waves. Thus the "Belt" stays still and the crew moves along it.

After the staking of the line has had a sufficient head start the hole-digging crew digs in; close behind are the pole distributors. The pole sheet tells them what class of pole and what type of assembly to leave at each stake. Another crew attaches the hardware to the pole prior to its being raised. Pole setting crews are next in line, followed by the wire stringing gang. Transformer hanging and the installation of service drops, the wires carrying the current from the pole to the house, are performed by separate crews. Construction at the rate of three miles or more per day with one complete set of crews is usual on fairly long lines. A few projects have been completed with an average rate of more than four miles per crew day.

Time Savers and Money Savers

The development of standard sag curves has added greatly to efficiency in staking lines. Formerly it had been customary to prepare a profile for each terrain, from which engineers determined the proper spacing of poles. The profile now is unnecessary, as the staking engineer does his work accurately and on the spot, getting all of the pertinent data from the standard chart.

Because the so-called rural-type transformer, used in the early days of the program, did not perform satisfactorily, REA reluctantly decided to use the more expensive conventional type transformer. The size of the potential market, however, led manufacturers to develop an improved type of single-bushing transformer which meets all REA specifications yet costs less than did its predecessors. Together with manufacturers, REA engineers have designed a simplified hanger for transformers. The same hanger bracket permits attaching the transformer to the pole in either of two positions, insuring proper placing according to specific conditions.

Two new special-purpose slide rules have been per-

ected by members of the REA engineering staff. One is used to determine immediately the buying requirements of any pole. Previously, involved computations or at least reference to unwieldy tables confronted



Courtesy REA
Vertical Construction Adopted by the REA

the engineer calculating the correct size for guy wires, guy rods, and anchors. With the new slipstick any problem can be worked in a few seconds. The other slide rule, covering voltage regulation, enables the engineer quickly to determine the correct conductor size for all normal distances, consumer densities, and consumption levels.

Emergency Power

Since the time of adoption by REA of mobile generating plants for emergency power, much improvement in their design has been effected. The newer mobile plants include transformers and connecting switches built directly on the unit; formerly the transformer installation was apart from the ruck. Considerable savings in lubricating costs have been brought about by including in the unit purification equipment for the lubricating oil.

Foiling the Boids

In the vernacular of the "Dead End Kids," one sometimes sees thooity poiple boids sitting atop an electric coicuit eating doity woims. As they boip and choip some of the more curious are apt to closely inspect the nearby transformers. In the old days this was disastrous; the coicuit would shoit, the boid would

boin, and the erl in the transformer often would berl. But them days is gone forever.

On the old transformers, the familiar 4.7-inch spark gap shunted around the insulator was a source of danger to our winged friends and a source of trouble for REA engineers. The Engineering Division, in cooperation with the industry, has designed a double lightning protection gap to replace the old single gap, successfully eliminating bird trouble in the transformers.

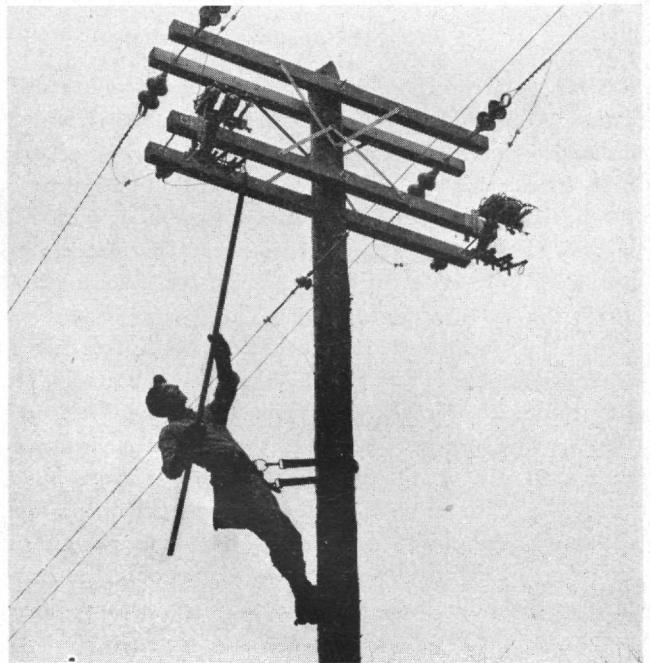
The steel brackets formerly used to hold fuse cut-outs and lightning arresters have been replaced by wooden brackets because of similar trouble with birds. Birds are not the only creatures causing unnecessary short circuits, however, as is illustrated in the case of a southern REA project where the current went off one calm night for no apparent reason. The next morning a charred owl and a scorched 'possum were found at the bottom of a pole, still entwined in a death struggle.

Shades of Dan'l Boone

A tale which reminds one of the pioneer days and the resourcefulness of our forefathers is that of the farm boy who saved the day when flood waters washed out the footing of a pole on one of the lines of the Boone County, Idaho, project.

One of the highest and longest floods in the history of that region broke through the protective dikes near Sandpoint carrying with it a pole which had been set on the bank of an old wash in order to give the lines legal clearance over the higher dikes. The pole, hanging on the line and swaying with the current, caused

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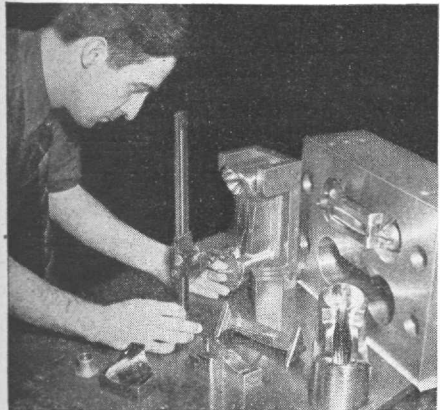
Courtesy REA
Cross Arm Construction Avoided Where Possible by REA for Benefit of Economy



How close an observer are you?

You probably handle nickels every day. Ever notice the wording on them?

Perhaps you handle a Bell telephone every day. What words appear on it?



This Western Electric worker is measuring a molding die used in making the telephone "hand set." Its size must not vary from the standard more than 5/10,000 of an inch—about one-fifth the thickness of this paper.

When you look at your Bell telephone you'll see (among other words):

The Western Electric name has been on telephones for 60 years, a symbol of quality in craftsmanship. It's the name behind the whole vast network of Bell System equipment that helps unite the nation.

Western Electric

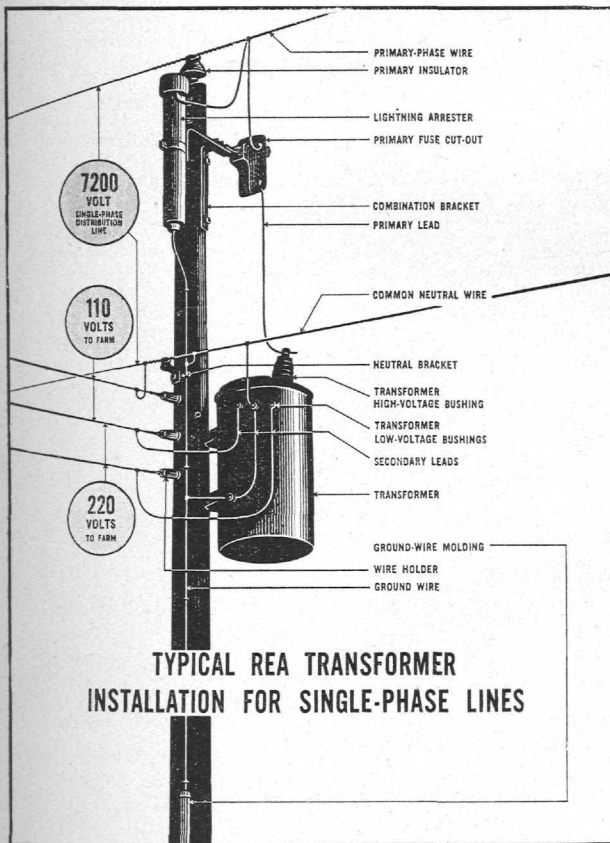
... is back of your Bell Telephone service

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the line to sag into the water at times, with resulting intermittent short circuits and interruption of service.

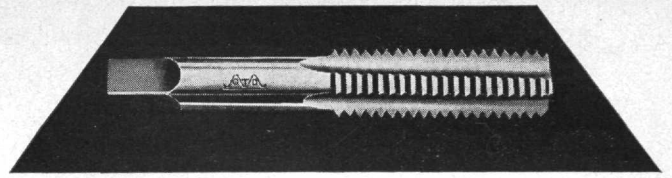
After replacing numerous blown fuses only to see the new fuses promptly burn out, project superintendent Glenn A. Smathers located the source of distress, noticing that the line shorted whenever the swaying of the pole pulled it into the water.

Rising to the occasion, he solicited the aid of a farm youth with a rifle. A modern Dan'l Boone, the youth proceeded to break the insulators, releasing the pole and allowing the wire to assume a graceful parabolic arc, easily clearing the water. Service was immediately restored to the entire line although it was 6 weeks before flood waters had subsided enough to permit replacement of the pole.



The REA will bear much watching in the future, especially from engineers and potential engineers who are interested in keeping informed on technical advances in the field of rural electrification. In a letter to the author; Robert B. Craig, then acting administrator for REA, remarked that "We have here a great many electrical engineers, who by their enthusiasm and interest are discovering many new and important facts about the distribution of electricity. If you are interested in the electrical field I would suggest that you try to keep in touch with the developments brought about by all the agencies in both the generation and distribution of electricity as a means of assisting you to a well-grounded education."

December, 1941



A TAP LOOKS QUITE SIMPLE

BUT...

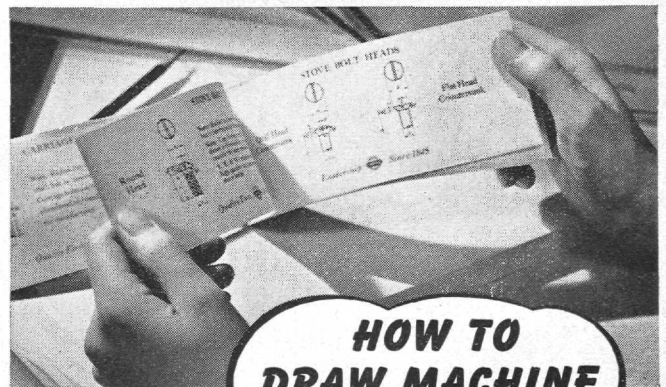
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