Farming with Electricity

A Hundred-Thousand Acre Tract That Is Fully Equipped with Modern Machinery

By Ralph Howard

HOW the barrenness of the desert has responded to the reclaiming touch of man is an oft-repeated story of the West, the Government project embracing 121,310 acres in Cassia and Minidoka Counties, Idaho, being a notable illustration. The astonishingly swift transformation of this once vast area of desolation into a fertile farming region—all within 13 years—is an inspiring achievement of itself, but of more singular distinction is the conspicuous rôle that electricity is playing in the farm homes of this big agricultural community. With 1,100 farmers applying electric current in producing and harvesting their crops, doing the chores of the housewife, and illuminating and heating the homes, schoolhouses and churches, no other rural section in the United States has accorded such all-embracing favor to this form of power as has this hydroelectric project in south central Idaho.

Electricity as a servant of city dwellers is of increasing popularity, but its common adaptation to rural life is a dream of future accomplishment. Its use in agricultural areas is a novelty, restricted to isolated examples in progressive communities. Herein the Minidoka enterprise, administered by the Reclamation Service of the United States Department of Interior, takes a radical departure. Electric current becomes an agent of almost universal recognition in an expansive rural area, where the most populous town, Burley, claims only 4,000 inhabitants. Rupert, a village of ranking importance, has barely 2,500 souls; the two mentioned burghs being products of the reclaiming powers which extended its magic wand over 121,310 acres and transformed the desert into agricultural units yielding a wealth of alfalfa, potatoes, sugar beets, small grains, as well as nurturing a beef and dairy cattle industry. No manufacturing industries of consequence are fostered; two beet-sugar factories, a potato dehydrating plant, two cheese factories, and several alfalfa mills, constituting the magnitude of manufacturing. All of which brings into relief the aspects of a slogan

of the city, "Do it electrically"—applied on the farm.

The engineering equipment includes a diversion, power and storage dam on Snake River, 7 miles south of Minidoka, two canal systems, one on each side of the river at the diversion dam, and three main pumping stations. There are 634 miles of canals, and the gravity system embraces 72,348 acres. The power plant is a creature of necessity in pumping water to approximately 50,000 acres during the irrigation season; thereby, the electric current distributed to country dwellers is a by-product. Of the 3,000 consumers of electricity, 1,100 are honest-to-goodness farmers. Substations have been built and distributing stations have constructed 290 miles of 2,200-volt circuits, extending 250 miles through rural communities. Although avoiding extensive retailing of electric power, the Reclamation Service takes the initiative in the organization of companies composed of farmers, which are incorporated and operate as mutual enterprises under the statutes of Idaho. These operating units build their own 2,200-volt lines, install transformers, and dispense current to individual consumers. The Federal Government acts as a wholesale distributor of power which is obtainable at substations conveniently located on the 30,000-volt transmission system.

The energy as supplied wholesale by the Department of Interior to farmer companies is based on a charge of \$2 a month per kilowatt of maximum demand for the equivalent of the first 50 hours' use of the maximum demand for the month; 3 cents a kilowatt-hour for the next 50 hours' use of the maximum consumption; 2 cents per kilowatt-hour for the succeeding 50 hours' consumption of the ultimate needs; 1 cent a kilowatt-hour for the next 150 hours' use of the maximum requirements; and $\frac{1}{2}$ cent a kilowatt-hour for all energy used in excess of 300 hours' use of the supreme needs. The rate also recognizes a block discount based on the contractor's guaranteed maximum demand, increasing from 2 per cent for 2-kilowatt contracts up to 30 per

cent for a contract of 100 kilowatts or more. Likewise a discount of 10 per cent is granted wherever energy is delivered and measured at 2,200 volts. A rural distribution line, including accessories, can be built at an expenditure ranging from \$500 to \$1,000 a mile; ordinarily four farms being linked for each mile connected to the circuits. The farming unit is 80 acres. Twenty farm companies have been organized, supplying approximately three-fourths of the rural consumers. Other users receive their electric current from lines vitalized by the systems of the various towns, barring 40 farmers who obtain a supply direct from the Government on individual contracts.

Interesting observations have been assembled as the results of study of the distribution of electricity on this Government project, which is the premier rural consumer in the United States. The use of a diversity of electrical appliances improves the load factor, and the energizing current of the rural dwellers' transformers floating on line likewise enhances the load factor. The load tests indicate that the companies' peak burden is always at the time of the lighting peak. The individual farmer consumer has a day peak, which averages three times his average night peak. The diversity of the day burdens, however, is such that the excessive individual needs do not affect the companies' maximum demand. The companies' evening peak is three to five times greater than the day load. The power factor of a rural company rarely exceeds 50 per cent except during the evening lighting peak. Distribution losses in kilowatt hours range from 30 to 50 per cent, primarily attributable to the energizing current of the transformers. One-half of the rural distribution systems employ iron wires for conductors. The largest company on the project serves 165 farmers on 38.5 miles of line, comprising 13 miles of 3-phase No. 6 copper wire, 3 miles of 3-phase No. 8 iron wire, 3 miles of single-phase copper, and the remainder single-

(Continued on page 399)

Correspondence

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The Einstein Contest

To the Editor of the SCIENTIFIC AMERICAN:

It is a real pleasure to read the prize essay on the Einstein theory and note the absence of weird mathematical symbols. One who has completed the ordinary college mathematical courses including calculus, feels that he has a real grievance when he encounters strange mathematical symbols, with no hint as to what they mean or how their meaning can be found at the library. He may also have a sneaking suspicion that the thirteen super-minds might be slipping something over. Having hastily suppressed that thought, perhaps he recalls instances where he himself has used mathematics to solve a problem and found that there was more than one answer. Perhaps one of the answers involved $\sqrt{-1}$ known as an "imaginary" answer, or for some other reason the conclusions drawn from it would be even stranger than those of the Einstein theory. All of which confirms the proverb that mathematics is a good servant but a bad master.

The statement that a yard-stick changes its length when turned around 90°, and that a watch runs at a different rate when on a fast train, will not be accepted by the skeptics on the mere statement that it is so, nor on proof so entirely mathematical as to be beyond control. Of course the essayist could not be expected to prove anything. He was only expected to explain, and this he has done so well that he, Mr. Higgins and the SCIENTIFIC AMERICAN deserve the greatest credit.

The weak point is the failure to state definitely the fundamental assumption on which the entire theory is founded, viz.: that the absolute velocity of light (in a vacuum) is constant. In other words that all space is filled with a fixed ether that does not partake of the motion of the earth. This ether was invented long ago to explain the transmission of light. A very attenuated kind of super-gas will not answer the require-

ments. It must be a solid body, vastly more rigid than the strongest steel, and yet allow the earth to pass right through it without offering the slightest resistance and without being displaced the slightest amount by the earth. In accepting such an ether, one is simply forced to make some mental reservations. Perhaps it should be taken in the sense of the familiar comparison between electricity and a circulating system of water pipes. It can't be taken too literally.

While such a fixed ether explains nearly all the facts about light, it does not explain quite all. It is directly contradicted by the measurement of the aberration of light, with a telescope filled with water. The ether theory is not so well established but that it is still subject to minor modifications. The ether, for example, may not be fixed; some of it may be carried around with the earth, and there have been other suggested modifications of the ether that would entirely upset the Einstein theory.

With a fixed ether, of course the earth would sweep through it at some 18 miles a second, in its orbit around the sun. At midnight the ether would seem to us to be coming from the east. Its direction would change, as the earth rotates on its axis, so that by morning it would seem to be coming down on our heads.

This is the way the ether was supposed to be sweeping through the laboratory while Michelson and Morley measured the velocity of light. Yet it was found that the apparent velocity of light was the same at all hours, and that is right where the trouble started that is threatening to drive us crazy.

To the normal mind this experiment simply showed that the ether was not rushing through the laboratory at 18 miles a second. Einstein's deductions are all the proof that is necessary that the laboratory was not moving through the ether at all. But the German mind when confronted with the discrepancy between the theoretical result and the experimental result, instead of seeing that one or the other result must be wrong, saw that both results were right and all the rest of the world wrong. So the discordant results were equated to each other, the equation was solved, the interpretation of the solution was proclaimed, and the world was plunged into mental anarchy.

But let us make another experiment. This one won't cost anything because the skeptics will agree with the super-minds as to the outcome and will disagree only on the explanation. Let us take two clocks: one with

a balance wheel escapement, the other with a pendulum escapement. The axis of the balance wheel will be placed parallel to the axis of the earth. We will neglect the velocity of about a quarter of a mile a second due to the rotation of the earth on its axis and assume that the motion of the axis of the balance wheel through space is uniform. The time rate of this clock will therefore be uniform. The pendulum of the other clock will beat at the normal rate at noon and midnight when its motion through space is transverse. But in the morning and evening its motion through space will be endwise, and Einstein tells us that its length will shorten. Therefore it ought to beat faster. If the earth's radius also shortens, gravity ought to get stronger and cause the pendulum to beat still faster. Every one will agree that the two clocks will actually keep together. To the skeptics there is nothing about this to explain. It is up to the super-minds to show some effect that would exactly compensate for the supposed change in length; presumably by amending the law of gravitation. It would be very interesting to know how this can be done without annulling their proof of the motion of the planet Mercury. But we will never know; because if they should answer this question it would be with another flock of weird symbols of unknown meaning.

GILBERT S. WALKER.

New York.

The Knife and Fork in One

To the Editor of the SCIENTIFIC AMERICAN:

In a recent issue I saw a description of a "new" combined knife and fork for the use of maimed soldiers. I think, but am not sure, that the implement in question was sold by Gamage of London, Eng., long before the Great War.

It is a very old tool; by the courtesy of Messrs. Read of Dublin, I was allowed to make a tracing of their model, the age of which is uncertain, but well over 120 years. This firm sells occasionally to special customers razors, knives (all descriptions) and scissors guaranteed over 100 years old. The steel is known to them as "silver steel," is of magnificent quality, polishes the color of silver, and retains the edge for years without regrinding, or in the case of razors, resetting. The business was started 273 years ago and has continued without a break.

(Rev.) R. W. TALBOT.

Loughrea, Ireland.

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Fuel Conservation Opinions—II

(Continued from page 397)

zones. Already power plants are being located at the mines, so as to eliminate the transportation of coal, and serving to distribute electric power to the erstwhile coal consumers over quite an area. Again, small power plants in thickly populated sections of the country are gradually becoming substations of larger plants. Indeed, there are ample signs that the super-power zone idea is gaining ground, automatically and without attracting much attention, to be sure.

The Fuel and Power of Tomorrow

Speaking of new fuels and sources of power, it is interesting to learn that Californian power plants have recently been offered a new fuel—crude oil residue—produced by the oil companies from fuel oil by breaking the crude oil down into its constituents to a greater degree than has heretofore been the practice. The problem of suitable storing and firing methods for this new fuel is at the present time being studied. The quantity of its supply is limited, since it will be a by-product from the distillation of crude oil.

Several large users of fuel are watching with interest the development of powdered fuel and colloidal fuel, which is now going on; but it is difficult to obtain a definite opinion as to the probable future of these fuels.

Lignite, even of the low grade North Dakota variety, will undoubtedly be more generally used in the near future, we are told by other authorities. Heretofore stoking equipment had not been developed that would burn the lignite satisfactorily, but the advent of recent automatic stokers has provided a means to utilize this cheap, low grade fuel, and an increased use of lignite can be confidently expected.

Our attention is directed to the great possibilities of obtaining higher efficiency from the fuels now used, and the saving of the by-products, as well as the expanding area of oil-producing sands and shale; also, there are possibilities for methyl alcohol and other fuel products. Indeed, if we grasp the idea of certain authorities correctly, it would seem that we are only at the doorway of Nature's storehouse, and that we might well learn first to make the most out of our present fuels before we seek new varieties. There is little doubt but that we shall be using powdered coal and gasified coal in ever-increasing quantities in the not distant future, after first extracting the valuable by-products, thus substantially reducing the cost of the fuel by obtaining certain by-products that are not permitted to go to waste. But before much progress can be made along these lines, the problem as a whole should receive considerable publicity and no end of study.

Edison suggests that the volcano and hot spring areas in the United States might give considerable power by means of deep bore holes and turbines. This scheme, it will be recalled, is in successful commercial use in Italy.

But it is a fact that human nature never seeks a definite solution of a problem until the problem becomes acute. There may be exceptions—Germany's development of her brown coals is an example, a very rare and worthy example, it goes without saying; but as a general thing the users of fuel are content in the assurance that of bituminous and anthracite coals, of petroleum and the lighter oils, of alcohol and of natural gas, and of all the other fuels which we are using today, there is an ample supply for many years to come. Hence the prevalent implied attitude. Why worry?

Farming with Electricity

(Continued from page 387)

phase iron. The connected load is 250 kilowatts, which is carried by 200 kilowatts of distribution transformers. The maximum use of energy occurred in April, 1920, when 10,920 kilowatt-hours were de-

livered from the substation to the company's feeders with a recorded maximum demand for 35.2 kilowatts.

The housewife shares generously of the benefits accruing from the application of electrical labor-saving devices on these Idaho farms. Many homes have been constructed without chimneys; electricity serving the purposes of illumination and heating, as well as the operation of the washing machine, sewing machine, and cooking appliances. Even the offspring of Mother Hen is warmed by current generated from the power plant, a carbon-filament lamp being installed in the chicken coop. Electrically-driven pumps supply water to the homes, and the farmer hooks a motor to a jack shaft, which drives the pump, cream separator, grindstone, feed grinder, and other useful machinery. The electric iron enjoys almost universal popularity, there being 1,862 flatirons in use. The washing machine is operated by electricity in 875 of the homes of the rural consumers. Vacuum cleaners, curling irons, ranges, moving picture machines, coffee urns, percolators, fans, water heaters, adding machines, vibrators, bake ovens, sterilizers, air warmers, and heater pads are among the electrical appliances in use. Seventy per cent of the residents on this Government project being owners of sheep, electricity for pumping water to the stock minimizes labor requirements. All told, 5,141 electrical appliances are in use, their popularity being represented by a 54 per cent increase within twelve months.

When Oysters Are in Season

(Continued from page 388)

from New York and New England to foreign countries involves the use of barrels containing three bushels and one-half peck, the container having a head. Hotels and restaurants serve oysters on the half shell, the "Blue Points" from beds of a cape on the south side of Long Island enjoying a distinction when thus placed on the menu. Likewise oysters are shipped in the shell from eastern waters to the Pacific coast for propagation purposes.

Shucking is described as the process of divorcing the meaty contents from the shells, tables or stalls in oyster houses being assigned for the separation proceedings. The water products are conveyed to the tables by wheelbarrows, in small establishments. In more pretentious oyster houses, the oysters are first taken to a storage room and let down through chutes to the individual stalls of shuckers. The operator stands on a bench before the table, upon which the shell fish tumble from the descending movement through slanting chutes. Blocks are accessible for placing the oyster for opening. Skill and muscle power are requisites for shucking. A mitten is worn on the left hand to avoid contact with the knifed edges of the shell, the hand of the shucker moving with incredible speed. A knife is used in prying the shell apart. From ten to twelve gallons constitute a reasonable day's work. The meaty contents are deposited in a galvanized-iron container, while the shells gain admittance to a trough in the shucking table whence they are transported for concentration by a mechanical carrier. The meat of the fish may be then robbed of its excess fluid by perforation. In small oyster houses the shells are deposited on the floor alongside the shucker and later removed in wheelbarrows. A movable wooden stall, 18 or 20 inches wide, quarters the operator and protects him from the accumulating mountain of shells. During the season of 1919-1920, shuckers were paid from thirty-five to forty cents a gallon.

Once deprived of their shell-enclosed home, the meat of the oyster is placed on washing tables. Simple in construction, these units are made of galvanized iron, measuring 5 feet long and 2½ feet wide, and supported on a wooden framework. Water drainage is effected through a per-

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