Vast Power of the Sun Is Tapped By Battery Using Sand Ingredient

Special to The New York Times.

MURRAY HILL, N. J., April 25—A solar battery, the first of its kind, which converts useful amounts of the sun's radiation directly and efficiently into electricity, has been constructed here by the Bell Telephone Laboratories.

The new device is a simple-looking apparatus made of strips of silicon, a principal ingredient of common sand. It may mark the beginning of a new era, leading eventually to the realization of one of mankind's most cherished dreams—the harnessing of the almost limitless energy of the sun for the uses of civilization.

The sun pours out daily more than a quadrillion (1,000,000,000,000,000) kilowatt hours of energy, greater than the energy content of all the reserves of coal, oil, natural gas and uranium in the earth's crust.

With this modern version of Apollo's chariot, the Bell scientists have harnessed enough of the sun's rays to power the transmission of voices over telephone wires. Beams of sunlight have also provided electricity for a transistor in a radio transmitter, which carried both speech and music.

The Bell scientists reported they had achieved an efficiency of 6 per cent in converting sunlight directly into electricity. This, they asserted, compares favorably with the efficiency of steam and gasoline engines, in contrast with other photoelectric devices, which have a rating of no more than 1 per cent.

With improved techniques the efficiency may be expected to be increased substantially, they added. They observed that nothing is consumed or destroyed in the energy conversion process and there are no moving parts, so the solar battery "should theoretically last indefinitely."

The experimental solar battery uses strips of wafer-thin silicon about the size of common razor blades. These strips are extremely sensitive to light. They can be linked together electrically and can deliver power from the sun at the rate of 50 watts a square yard of surface.

The atomic battery recently announced by the Radio Corporation of America delivers one-millionth of a watt. The new Bell solar battery thus delivers 50,000,000 times the power of the R.C.A. atomic battery.

Silicon is a semiconductor,

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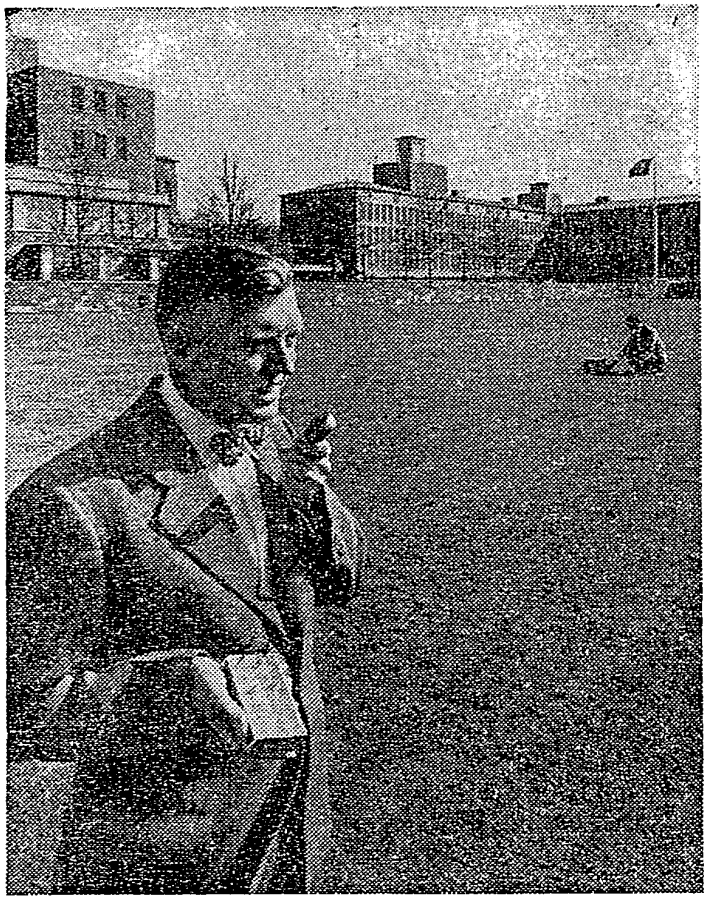

SOMETHING NEW UNDER THE SUN: The sun's rays falling on new Bell solar battery provide the only source of power needed to operate small mobile radio transmitter. D. E. Thomas, Bell Telephone Laboratories engineer, demonstrates that his voice can be heard clearly on receiver across the lawn of the Murray Hill (N. J.) laboratories.

NEW BATTERY TAPS SUN'S VAST POWER

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chemically related to germanium, the material used in most transistors, which were also invented at the Bell Laboratories and are expected to supplant the vacuum tube. Silicon has a much greater electronic stability at higher temperatures than other semiconductors.

The solar energy battery, along with other silicon devices demonstrated at the laboratories, resulted from a broad fundamental study of silicon and its possible application in modern electronics. The revolutionary device was developed by a three-member team —G. L. Pearson, C. S. Fuller and D. M. Chapin, physicist, chemist and electrical engineer, respectively.

Among other silicon devices being studied at Bell Laboratories is a lightning protector for telephone lines that would be more compact and easier to maintain than those now in use. Also under study is a power rectifier that can convert very large amounts of alternating current into direct current.

An important feature of these silicon devices, it was said, is that they can operate at much higher temperatures than other crystal rectifiers now in use. They are also said to offer numerous advantages over equipment now in use "where ruggedness, long life and reduced maintenance costs are significant factors."

The key to the new techniques for producing these silicon devices is the controlled introduction of a foreign element into a microscopic layer near the surface of a thin slice of silicon. This process has been developed at the Bell Laboratories by Mr. Fuller.

Treatment under gas at high temperatures permits the introduction of minute traces of impurities into the atomic structure at the surface of the silicon. Introduced at a precise rate and under carefully controlled conditions, the impurities reach a depth of less than one ten-thousandth of an inch.

This, it was explained, is essentially what is known as a "p-n [positive - negative] junction," which is the heart of all these devices and which, when built into a germanium single crystal, is the basis for the junction transistor, also invented at the Bell Laboratories.

Scientists have long sought a practical method of converting the limitless energy of the sun directly into electricity. Until now only the thermocouple and the photoelectric cell, limited by their nature to handling minute quantities of power, have been available.

A demonstration of the new solar battery will be given at the annual meeting of the National Academy of Sciences in Washington tomorrow.