ELECTRONICS

Can Replace Transistor

THE CONCEPT of molecular electronics may lead to development of a complete communications receiver the size of a pea.

The concept is said to "leapfrog" over current attempts to make electronic systems smaller and more reliable. Its further development may mean the eventual elimination of such components as resistors, capacitors, diodes and transistors.

The technique, demonstrated by the U. S. Air Force and Westinghouse Electric Corporation in Washington, D. C., "grows" semiconductor crystals in the form of long, thin, near-perfect ribbons, or dendritic strips. The dendrites can be incorporated into finished semiconductor devices without intermediate material processing of any kind.

Westinghouse scientists have grown multi-zone crystals, called "functional electronic blocks," that provide the basic building blocks required in molecular electronic systems. Each one is a complete functioning electronic sub-system.

A variety of working sub-systems shown were vastly more reliable than the most advanced electronic devices in use today and as much as 1,000 times smaller.

Dr. S. W. Herwald, Westinghouse vice-president in charge of research, demonstrated an amplifier used in a high fidelity phonograph in which the pre-amplifier was the size of a match-head and the power amplifier was small than a dime.

"If this can be accomplished now," he said, "it isn't difficult to foresee development of a complete communications receiver the size of a pea within a few years."

Also shown was a wafer-sized direct current power amplifier that required only the energy from a flashlight beam to control 40 watts of power for two 12-volt automobile headlamps.

New systems employing these concepts, the demonstrators pointed out, could be operational in missiles or satellites in three to four years to perform such functions as telemetering light intensity or radiation levels back to earth and providing infrared detection and reconnaissance information, flight guidance and communications.

To construct molecular electronic systems, Dr. Herwald said, it is first necessary to determine the desired electronic functions to be performed and then build those functions into a single piece of semiconductor material such as silicon or germanium.

By such techniques as plating, etching and alloying, the structure of the tiny solid piece is arranged to perform the identical functions that now require many individual components that have to be soldered together.

MOLECULAR AMPLIFIER — This tiny unit performs the same function as a conventional standard amplifier. Developed by Westinghouse Electric Corporation in cooperation with the Air Force, such units are as much as 1,000 times smaller than electronics devices now in use.

MEDICINE

May Aid Cancer Treatment

See Front Cover

A NEW RADIATION detector, smaller than the head of a pin, is expected to have important applications in the treatment of cancer.

The device, which measures the number and energy of atomic particles traveling at extremely fast speeds, is also expected to have uses in space exploration, military science, nuclear power control, industrial process control and basic physical research.

Known as a "solid state ionization chamber," it was developed by Hughes Aircraft Company, Los Angeles, and a report on the device was recently presented before the American Physical Society in New York.

The detector, seen on the cover of this week's SCIENCE NEWS LETTER, is essentially a slice of "doped" silicon so thin it is barely discernible to the eye. When struck by a charged nuclear particle, it emits a pulse that can be measured and analyzed. The detector's value lies in its ability to make measurements that up to now could not be made, Dr. Stephen S. Friedland, Hughes physicist, reported.

The detector is said to have five major advantages over earlier devices. It is so small that it can be packaged in the tip of a hypodermic needle. It requires no cumbersome power pack because it operates at very low voltage.

Furthermore, it can detect particles 1,000 times faster than previous devices and is so accurate that it can analyze particle energy to less than one-half of one percent error. Ordinarily tiny, the device could be made larger for alpha particle detection in low radiation level areas.

Dr. Friedland described the potential use of the solid state detector in the treatment of cancer. Boron, an element that tends to concentrate in malignant tissue for a limited length of time, would be injected into a cancer patient. The detector, imbedded in a hypodermic needle, would be inserted into the diseased area.

The patient would then be exposed to a stream of neutrons. When the boron reached its heaviest concentration, neutrons striking it would create alpha particles that would flash through and destroy diseased tissue.

The detectors would spot the alphas and determine when boron concentration reached its peak and how long it lasted. This information would be transmitted instantly to readout devices, allowing technicians to plot precisely future treatment and to determine the minimum effective exposure to radiation.

GEOLOGY

Tundra May Have Lined Edge of Great Glacier

FOR YEARS scientists have held that great spruce forests extended to the very edge of the great glacier of the ice age. Now a geographer from Michigan State University at East Lansing, Mich., is disputing this claim.

Dr. Dieter H. Brunnschweiler contends that the area just south of the glacier was similar to the treeless plains of the Arctic, a tundra covering a broad cross section of the U. S. from Oregon and northern California to the Middle Atlantic states.

As evidence, he points out that stone formations in this belt are similar to those found in the Arctic tundra, where frost is in the ground all year. Other tundra-like conditions, he says, include lakes without outlets in Delaware and eastern Maryland, which he believes were depressions formed by freezing and thawing processes.

The theory that the area south of the ice cap was forest, the geographer maintains, was formed by biologists and was based on findings of spruce pollen supposedly dating back to about the time of the last ice advance. Dr. Brunnschweiler, on the other hand, thinks the spruce trees migrated southward as the glacier advanced.

There is general agreement, he adds, on what temperatures prevailed south of the glacier. Estimates based on the depth and distribution of former frost activity in the ground indicate the average low was zero to 10 degrees Fahrenheit and the average high was 40 to 50 degrees. This matches with temperatures in present tundra, the researcher notes.

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