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# Glass Mini-Switch May Outdo Transistor

By Alton Blakeslee

TROY, Mich., Nov. 10 (AP)—Basic new discoveries in physics promise an electronic revolution as great or greater than that launched by transistors, says inventor Stanford R. Ovshinsky.

Potential developments, he says, include:

- TV sets consisting of flat pieces of glass hanging like portraits on the wall, with no picture tubes. All circuits would be within the glass—only half to one inch thick—of any desired length or width.

- Smaller, faster, simpler computers for industry and the home, even a computer whose heart would consist of a thin film of metal and special material.

- Electronic switches far more resistant to radiation than present devices, for use

in intercontinental missiles. Antiballistic missiles are designed to neutralize the electronic "brains" of incoming warheads partly by bursts of nuclear radiation.

- A host of new or different electronic devices.

The key is new semiconductor switches, which are "simple, cheap and easy to make," Ovshinsky says.

They can produce current or turn it off within 150 trillionths of a second. One switch has a "memory" of what it was last told—and is capable of reproducing that information on demand.

The new switches, which Ovshinsky calls "Ovronics" are being produced in the form of tiny, glassy beads, or as films

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thinner than a human hair. The films now can even be applied to a surface just as a paint or varnish is applied.

Each film contains thousands of switching points within a square inch, so rugged they can be stepped upon without damage, the inventor and associates report.

Unlike transistors, which depend upon well-ordered crystalline structure, the new ones are made from glassy materials whose atoms are in complete disorder or disarray.

Ovshinsky reports on this unexpected phenomenon in the Nov. 11 issue of *Physical Review Letters*, published by the American Physical Society.

## Theory Explained

He and scientific consultants explained the theory and demonstrated switches in a background news conference here Friday at Energy Conversion Devices Inc., which is producing switches for study and evaluation for various uses. Ovshinsky, 46, whose formal education ended with high

school, is president of the company. He holds 38 patents.

The new devices contain mixtures and alloys of such chemicals as tellurides, selenides, borides, arsenides, oxides and sulfides. A thin layer of such material, after heat treatment, is placed between two metal electrodes.

It does not conduct current until a certain voltage is applied. It switches on, then off when the current falls. It can switch direct current and alternating current as well. A single transistor cannot do this alone.

A fundamental difference from transistors is that the new switches contain a large reservoir of electrons—all of which are bound to other atoms. These can be "excited" to produce current above a certain threshold of applied voltages, says Dr. Hellmut Fritzsche, University of Chicago physicist, and a vice president of the company.

## 'Commercial Secrecy'

Ovshinsky said he placed the development under "commercial secrecy" while research was going on in order to protect his company until patents are secured.

[One problem in developing the devices is that its atomic structure is less susceptible to analysis than that of crystalline transistors, and thus its reliability cannot be demonstrated theoretically, though it can be shown by trial and error.

[Physicists disagree as to the uniqueness of the switching and memory effects described by Ovshinsky. In 1962, Dr. A. David Pearson of Bell Telephone Laboratories discovered a switching and memory effect in a number of glass-like substances.

Ovshinsky and some physicists who have worked with his devices say that Pearson's work and Ovshinsky's have only superficial likenesses. However, Ovshinsky's use of the term "Ovshinsky effect" to describe the switching phenomena does not set well with physicists, who view the work of both men as similar.]

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