

"Two-in-one" Automatic Vendor

Japan is still a land of contrasts. At a time when it is possible to pay for telephone calls with plastic cards sold by convenient automatic dispensers, the nation is still dotted with tens of thousands of tiny corner tobacco shops, dispensing a few packs of cigarettes a day and usually coming equipped with an old-fashioned pay phone. But if technology has its way, a new hit vending machine could signal the end of this venerable tradition.

In September 1984 Kubota, Ltd., Japan's second largest manufacturer of tobacco vending machines, started developing a vending machine that could dispense both cigarettes and telephone cards, and sales have been so brisk since it was placed on the market last June that the first year target of 2,000 units has already been attained.

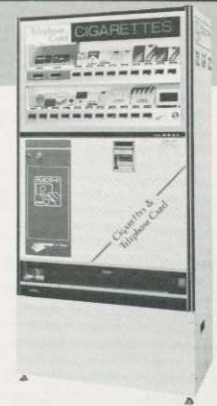
The "two-in-one" automatic vendor retails for ¥1,588,000 (\$7,940). It can dispense 20 different brands of cigarettes and two different kinds of telephone cards. Compared with installing two ma-

chines, the two-in-one vendor means space and cost savings of 20%.

Behind the brisk sales is the rapid diffusion of pay telephones which use plastic cards. It was in December 1983 that the then Nippon Telegraph and Telephone Public Corporation (now the private NTT) began installing card-type telephones. The magnetized cards—available from automatic dispensers—cost from ¥500 to ¥5,000 and automatically keep track of how many calls have been made up to the prepaid limit.

About 18,000 card-type pay telephones have already been installed throughout the country, and more than 10 million cards have been sold. They are currently selling at a rate of some two million a month. NTT plans to install another 36,000 card-type pay telephones by the end of March, bringing the total to 54,000, or 6% of all pay telephones in Japan.

At present there are two types of card-type pay telephones, one exclusively for



cards and the other for both coin and card. The card-only telephone is substantially smaller, but a new combination model to be installed this spring eliminates the size difference and is likely to become the new standard version.

All the pay telephones at Japan's 390,000 tobacco shops are still coin types, but NTT will soon start replacing them with the new compact coin and card sets. That, in turn, means a growing market for Kubota's new product. (Tsukasa Fukuma, staff writer with Kyodo News Service)

Semiconductor Laser with 4x the Power

Oki Electric Industry Co. has developed a very high-power semiconductor laser with potential applications in inter-satellite optical communications systems.

An Oki research team, led by Masaaki Sakuta, manager of the Oki Research Laboratory Optoelectronic Devices Department, has test-manufactured the laser diode, which boasts a maximum power density of 210 milliwatts per micron (a millionth of a meter). This density is far greater than that of conventional semiconductor lasers, which usually range from 40 to 50 milliwatts per micron.

"This breakthrough," explains Sakuta, "has been made possible by optimizing the atomic arrangement in the active layer material of this laser to avoid the degradation in a high-power output operation."

The laser is constructed using thin-film growth techniques, so-called liquid-phase epitaxy, on a gallium arsenide substrate. It has a double-hetero structure, in which the active layer is sandwiched between two cladding layers of aluminum gallium arsenide. The silicon is doped into the gallium arsenide active layer during liquid-phase epitaxial growth with the silicon distribution controlled by growth temperature. One of the accomplishments of the Oki research

team was to find an appropriate growth condition for fabricating a high-power semiconductor laser.

Unlike lasers using gas and solids as light-emitting medium, a semiconductor laser is a very small chip measuring less than 1mm square. But the advantages of small size are counter-balanced by low output.

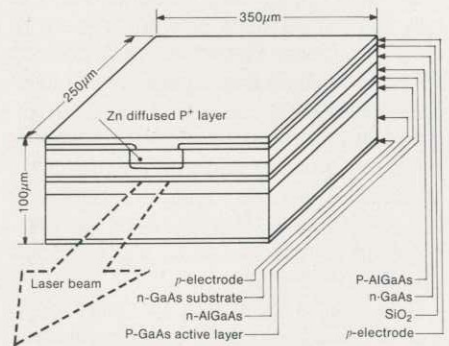
In semiconductor lasers made by existing processes, the light-emitting section (active layer) reabsorbs a small amount of the emitted light. The resulting heat degrades the laser, and has stood in the way of developing higher-power devices.

The heavily silicon-doped gallium arsenide used in Oki's new laser does not reabsorb the light. The new method of growing high-quality gallium arsenide doped with silicon also prevents distortions of the crystal lattice caused by conventional techniques.

According to Sakuta, the new laser diode will probably be put on the market as early as next summer. And he predicts his company could develop a semiconductor laser with a maximum per chip power density of 20 watts per micron with further research.

A host of applications awaits high-power semiconductor lasers, from light sources for night-time observation of

Schematic View of the High Power Laser



plants and animals to systems for checking damage in optical fiber cable.

Sakuta adds that such lasers could also be used as light sources for optical communications systems that do not use optical fiber. Such systems would be free from eavesdropping, making them invaluable for communications between satellites and military vessels.

Oki Electric has outpaced RCA and Xerox, which are also researching such lasers. The company has already received numerous inquiries from U.S. interests about the achievement. (Akira Shoji, staff writer with Kyodo News Service)