



Philips Electronic Instruments

Integrated circuit: A bright future.

and indium (in the Touch-Tone mechanism). There are constituents of 35 types of metals and alloys, 14 types of plastic, 12 kinds of adhesives and 20 different semiconductor devices.

The electrical and electronics industries account for 86 percent of the yttrium used in the United States, 85 percent of the indium, 80 percent of the gallium, 62 percent of the beryllium, 60 percent of the germanium and 55 percent of the tantalum.

Some of the elements essential in electronics are vulnerable either to worldwide shortages (mercury and tin) or to the export policies of foreign nations (gold, palladium, chromium). But these vulnerabilities are offset, Chynoweth says, by the relatively small quantities required and by the fact that in electronics the basic materials represent a smaller share of the cost of the product than in other technologies. He also says material or functional substitutes are available in many cases.

"For the integrated circuit, which is the heart of electronics, the prospect seems even more reassuring, because it is based

on silicon—the most abundant of all elements except oxygen. And since such small quantities of silicon are needed, this suggests that man can plan on using solid state electronics extravagantly and indefinitely."

The process of miniaturization, using solid state electronics, offers "enormous potential" for materials and energy conservation, Chynoweth says. An integrated circuit based on a silicon chip less than a quarter inch square nowadays incorporates thousands of transistors. Charge coupled devices (CCD's) offer a 10-fold reduction in weight and 100-fold reduction in operating power over magnetic drums. Chynoweth reports that CCD's also promise another dramatic development, a miniature, wireless, portable television camera no bigger than ordinary photographic cameras.

Further energy savings can come about in telecommunication through various electronics tricks. One example: In transmitting a video signal, transmission capacity can be reduced by transmitting only the changing portions of the picture.

Someday video transmission may substitute for some personal travel, "communicating to work rather than commuting," as the phrase goes. Electronics can substitute for some kinds of mail service. "Such substitutions," Chynoweth says, "could make positive contributions to materials conservation by lessening society's dependence on materials-intensive transportation and construction technologies [for vehicles, roads, offices and the like]."

"In view of the enormous versatility of solid state electronics it is reasonable to expect that man's ingenuity will continue to find new ways to exploit its materials- and energy-saving potential throughout all technology."

Chynoweth's is one of 25 articles in a special issue of SCIENCE devoted to materials. In the introduction Philip H. Abelson and Allen L. Hammond of SCIENCE call the long-term prospect for expanded supplies of raw materials "mixed at best." Trends toward nationalization of foreign-owned mining properties, higher energy prices that prohibit extraction of many low-grade ores, environmental constraints and increasing restrictions on access to public lands have seriously affected world supplies of raw materials. "These developments have created conditions dramatically different from those of a decade ago—a new world of materials. . . . What is perhaps most remarkable," they say, "is that their cumulative impact has not yet disrupted the supply of materials in a major way."

One bright spot. Hans H. Landsberg of Resources for the Future, Inc., reports that per capita use of raw materials in the United States has not been increasing exponentially, as some have feared, but has stayed about level since 1952. □

Marijuana report: Another approach

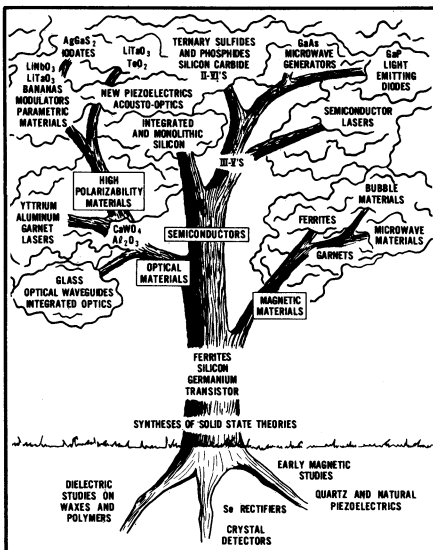
"Marijuana, an issue once marked by emotionalism, is increasingly being examined thoughtfully," said Robert L. DuPont last week in his introduction to the fifth annual report to Congress on marijuana and health. The report, prepared by the Department of Health, Education and Welfare, "does not," he says, "give marijuana a 'clean bill of health,' as some would hope. Nor does it support the fear and irrationality that still characterize some of the public debate about marijuana."

While still appearing to take the stance that marijuana is guilty until proved innocent, the report does show its thoughtfulness by devoting a good deal of time to a discussion of the possible therapeutic uses of the drug.

For the past 10 years, since delta-9-THC was first totally synthesized, a systematic study of the clinical pharmacology of cannabis has been underway. Taking the position that marijuana may prove to have specific benefits, the report lists the areas of research that seem most promising. Glaucoma and asthma are the two conditions that can definitely be treated with marijuana. The drug produces a decrease (up to 40 percent) in the intraocular pressure that causes glaucoma and blindness. Marijuana decreases airway resistance significantly and relieves the bronchoconstriction of asthma patients for hours. These uses, plus the recently reported use of marijuana as an antiemetic and antiemetic treatment for cancer patients undergoing chemotherapy (SN: 10/25/75, p. 262), are fairly well known. But the report goes on to list some other areas of research that show promise.

Preliminary work suggests a possible use of cannabinoids as anticonvulsant agents in the control of epileptic attacks. One study has reported reductions in tumor size (up to 82 percent) in mice after treatment with cannabinoids. As a sedative hypnotic, marijuana might be of help in treating insomnia and might replace barbiturates in some cases. The drug's sedative properties have also been shown to be helpful in relieving hangovers. Analgesic, preanesthetic and antidepressant uses are also suggested as well as possible use in treating alcoholics and relieving heroin withdrawal symptoms. Of special importance in the eventual therapeutic use of marijuana is the fact that there is a wide margin of safety between effective and lethal doses. An overdose is almost impossible.

"The hemp plant and its derivative chemicals turn out to be neither the best nor worst of substances," the report concludes. "Like everything else it should be used for its beneficial effects and avoided for its noxious aspects." □



A.G. Chynoweth/Science

The electronic materials tree. Progress rooted in science, based on transistor.