

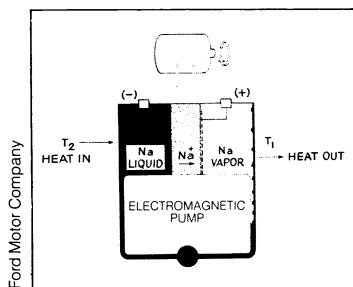
ENERGY

Ivars Peterson reports from Washington, D.C., at the 9th Energy Technology Conference

Electricity from a sodium heat engine

Scientists at the Ford Motor Company are developing a new device capable of converting heat directly into electrical energy. This device, called a sodium heat engine, has no moving parts and uses a small quantity of liquid sodium as its working fluid. Inventor Neill Weber and associate Thomas K. Hunt demonstrated a prototype system at the Energy Technology Exposition, held in conjunction with the conference.

Hot liquid sodium fills one side of a closed container divided into two parts by a ceramic wall of the compound beta"-alumina. The wall allows the passage of sodium ions but not electrons or sodium atoms. Thus, sodium ions go through the solid, ion-conducting electrolyte, while electrons travel an external circuit to provide a low-voltage, high-current electrical output. A sodium vapor pressure difference across the electrolyte generates the driving voltage. In the low-temperature part of the system, the sodium vaporizes from the electrode surface and then condenses on a cooled wall. An electromagnetic pump returns the condensed sodium to the hot region.



The device can use any source delivering heat at 700°C or more. Its efficiency, potentially in the range of 30 to 40 percent, is independent of the heat engine's size. A model designed for long-term testing has reached 19 percent efficiency at an output of 22 watts. The pump siphons off less than 0.1 percent of the energy output. The major problem with the system is deterioration of electrodes after several hundred hours of operation, which lowers the voltage and decreases power. Despite this problem, the sodium heat engine looks more promising than many earlier thermionic devices (SN: 4/1/78, p. 202).

The researchers say, "An efficient, durable, low maintenance, thermoelectric energy converter with good power density, made of readily available materials and with efficiency independent of size would have substantial implications for solution of some of the nation's energy, transportation and defense problems."

Potential applications include use in total energy systems for residences and factories, in remote locations and as part of solar energy installations that concentrate light. Even the rejected heat at the low-temperature end of the cycle can be used.

Eating sulfur out of a crude oil home

As much as 5 percent of crude oil, depending on its source, consists of sulfur-containing organic compounds. Removing the mixture of more than 200 different sulfur compounds that have been identified in oil requires a great deal of energy. Although patents have been issued as early as 1950 to processes using microorganisms that promised to convert sulfur compounds to water-soluble sulfates, technical problems prevented the application of these processes on a commercial scale. Extending the work of Japanese and other researchers, William R. Finnerty, a microbiologist at the University of Georgia, has taken another look at the use of microorganisms.

Finnerty concludes, "The selection of microorganisms that oxidize sulfur-containing or nitrogen-containing constituents of fossil fuels appears feasible and of scientific merit as a potentially useful applied energy-related technology. We have isolated microorganisms which oxidize and/or grow at the expense of specific sulfur- and nitrogen-containing aromatic compounds known to be present in liquid fossil fuels." He warns, however, that the work remains at a basic level of research.

BIOMEDICINE

A nation of sleepyheads

If you only listened to television commercials, you might think Americans' number one sleep problem was difficulty in falling asleep at night. But that isn't true, a study reported by Richard M. Coleman of Stanford University School of Medicine and colleagues in the Feb. 19 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION reveals. The major difficulty is excessive daytime sleepiness, not insomnia.

Coleman and his colleagues conducted a large survey of patients with sleep-wake disorders who had been diagnosed both objectively with electrophysiological recordings and subjectively with a new comprehensive diagnostic system drawn up by sleep-wake disorder authorities. The most common problems include:

- Fifty-one percent of the patients surveyed experienced excessive daytime sleepiness. This problem, in turn, was due mostly to any one of three sleep disorders — sleep apnea (43 percent), narcolepsy (25 percent) and idiopathic central nervous system hypersomnia (nine percent).
- Thirty-one percent of the patients surveyed were insomniacs. Thirty-five percent of insomnia cases, in turn, were due to trouble staying asleep because of psychiatric disturbances, 15 percent to difficulty getting sleep because of anxiety, and 12 percent to interrupted sleep resulting from drug or alcohol dependency.
- Fifteen percent of the patients experienced snoring, swallowing, choking or other behaviors while sleeping that either interrupted their sleep or their bedmate's sleep.
- The final 3 percent of patients surveyed had an abnormal sleep-wake schedule, most commonly where an individual's 24-hour temperature rhythm was phase-delayed three or more hours relative to the pattern seen in persons with conventional bedtimes and wake times. As a result, patients were unable to fall asleep until three or six in the morning.

Lung cancer: The American nemesis

More than one-fourth of American cancer deaths this year will be from lung cancer, the American Cancer Society predicts. This compares to 1950, when lung cancer accounted for only 8.7 percent of cancer deaths.

"If it weren't for lung cancer," says Lawrence Garfinkel, vice-president for epidemiology and statistics and director of cancer prevention at the society, "the overall cancer death rate would actually be going down." And the irony of the situation, he continues, is that "lung cancer is among the most preventable of all diseases. The best way to avoid getting it is to give up cigarettes." According to the 1982 edition of the ACS's *Cancer Facts and Figures*, smoking is responsible for some 83 percent of lung cancer cases among men and for some 43 percent of cases among women.

All at your fingertips

Because fingernails contain the same trace elements as the rest of the human body and because they can be easily clipped, they're a handy source for measuring the levels of various trace elements in the body. One of the problems with using fingernails for this purpose, though, is that the organic solvents and organic acids used to remove surface dirt and other contaminants from nails before analysis sometimes also remove the trace elements present in them.

A solution to the problem has now been found by Harvey Bank, a cell biologist at the Medical University of South Carolina in Charleston, and co-workers — washing nails briefly in detergent before analysis. It rapidly cleans them without altering their trace element composition.