TECHNOLOGY

Superconducting motors readied

Superconducting motors may soon revolutionize the motor industry for some applications. Smaller and lighter than the motors they replace, they promise considerable fuel savings because of higher efficiency. General Electric Co. is now preparing to deliver two prototypes to the Navy.

The first applications are expected to be in areas where conventional motors run into problems, such as in hydrofoils and SWATH boats (a craft that rides on a submerged tubular hull). In both these advanced vessels, mechanical linkage between an engine in the main hull and a propeller several feet below has proved a problem. In the new cryogenic system, a deck-level turbine would drive a super-cooled generator, which would in turn provide electricity for superconducting motors adjacent to the propellers.

Technical problems that have had to be overcome in designing the new motors include, of course, handling liquid helium to keep the motor windings cold, but another particularly annoying problem has been how to transfer current to the moving coils. Current densities required by the virtually resistanceless superconductors are many times higher than those that can be sustained by ordinary wire brushes, and previous designs have suffered severe wearing. The GE motors use instead a current-collector of liquid metal, which the makers claim will be so reliable that the whole motor assembly can be hermetically sealed in a steel enclosure. The 3,000 horsepower motors weigh less than a third of the equivalent conventional units.

Flywheels are off and flying

After favorable reports from earlier feasibility studies, the Energy Research and Development Administration (ERDA) is now spending $1 million a year to develop the flywheel for applications in transportation and utilities. A report of the state of the art appears in the July ENVIRONMENTAL SCIENCE AND TECHNOLOGY.

The use of flywheels as energy saving devices in fairly large units is not new. Flywheel buses have been used in such diverse places as Switzerland and the old Belgian Congo, and the Soviet Union today uses them in buses and windmills.

The advantage of flywheels is that they can be used to pick up energy that would otherwise go to waste—such as the energy needed to stop a vehicle, which is now lost as heat. Later the energy can be reconverted to help the vehicle start up again. Another scheme involves transferring energy to a flywheel from a motor that runs constantly at its optimum speed and then drawing the energy out again in spurts to drive a vehicle.

Two cars with flywheels are already in operation on the New York subway—where energy savings of 30 percent have been reported. If all the system's cars were so equipped, the annual saving of electricity would be about $20 million. Some experts believe that the flywheel may also provide the key to developing an electric car with acceptable range.

Water-gasoline mix debated

Emulsifying a water-gasoline mixture has been touted as a way of increasing fuel efficiency by as much as a third (SN: 12/29/73, p. 388). But in a paper delivered to the Society of Automotive Engineers meeting in St. Louis, General Motors engineers Bruce D. Peters and Russel F. Stebar report that such mixing increases hydrocarbon emissions as much as 50 percent, increases engine deposits, worsens the problems of cold-weather starts and adversely affects vehicle driveability. Although the system is beneficial in some respects, they conclude, "its disadvantages at present outweigh its advantages."

BIOMEDICINE

Mental retardation and radiation

Older women are more likely than younger women to give birth to infants with Down's syndrome (mongolism). This syndrome consists of mental retardation caused by chromosomal defects. The reason the offspring of older women are more at risk, however, has been elusive. Now there is evidence that older women have been exposed over a longer period of time to environmental radiation, and it is the radiation which triggers chromosomal defects in their offspring.

Humans accumulate about 5 roentgens of radiation from the environment in 30 years of reproductive life. Whether this exposure harms their reproduction, however, has not been known. N. Kochupillai and his co-workers at the All-India Institute of Medical Sciences in New Delhi, decided to see whether there was a preponderance of individuals with Down's syndrome in a coastal area of South India. Background radiation there is exceptionally high because of the presence of thorium-containing monazite minerals in the soil.

They made a house-to-house survey of developmental abnormalities in this area and in a control area without high background radiation. They also determined the frequency of chromosomal aberrations in the two populations. As they report in the July 1 NATURE, Down's and other forms of severe mental retardation of chromosomal origin were four times greater in the study population than in the control population.

Electric fields and nerve activity

When extremely weak electric fields, weaker than the field in the brain which gives electroencephalogram readings, were applied to brain tissue, they selectively inhibited the release of calcium from these tissues. These findings, by S.M. Bawin and W.R. Adey of the University of California, Los Angeles, are reported in the June PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

These results suggest that such frail fields may be intrinsic to the brain and somehow regulate neuronal activity. For instance, they might influence the release of calcium from nerve membranes, and the calcium would then interact with hormones.

Another pain-relieving molecule

Scientists recently discovered, for the first time, natural pain-relieving molecules in the brain and body (SN: 5/15/76, p. 309; 6/26/76, p. 407). Both were proteins. Now a nonprotein, pain-relieving molecule has been identified by Alan R. Gintzler, Aharon Levy and Sydney Spector of the Roche Institute of Molecular Biology.

As they report in the June PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, the molecule binds to antibodies primed against morphine.

Hormones and dehydration

The hormones vasopressin and oxytocin have traditionally been thought to originate in cells in the hypothalamus and to be transported along axons to the pituitary gland for storage and release. Dehydration releases both hormones from the pituitary, but any effects it might have on the hormones while still in the hypothalamus have been difficult to pin down.

Thanks to the technique of radioimmunoassay, Jack M. George of Ohio State University College of Medicine has now determined that dehydration decreases both hormones in the hypothalamus. And as he reports in the July 9 SCIENCE, dehydration possibly also leads to the synthesis of new proteins or polypeptide hormones in the hypothalamus.