TECHNOLOGY

A magnetic cushion for a cooler

North American Philips Corp. has come up with a lightweight refrigerator for the National Aeronautics and Space Administration that is unlike anything found in a kitchen. Packed into a compact, metal casing, the new cryogenic cooler's components work without bearings, seals or lubricants and do not wear down from friction. In recent tests, the cooler achieved 65 K (−343°F), almost enough to freeze nitrogen, and a cooling power of 5 watts. The refrigerator may one day fly aboard satellites to cool sensors for space-bound scientific instruments like infrared detectors. The device may also be useful for computers (SN: 6/26/82, p. 423) and biomedical instrumentation (SN: 4/9/77, p. 234).

The key to friction elimination is the use of magnetic levitation to suspend two pistons that expand and compress helium gas. They ride on a magnetic cushion with a clearance of only 0.001 inch from the walls. Eddy-current sensors continually monitor the gap and report to an electronic control unit that compensates for any shifts and keeps the pistons centered. Although magnetic bearings are not new, Philips scientists say this is their first application in a linear design. In addition, linear rather than rotary motors drive the pistons. A refrigeration system like this should operate, maintenance-free, for 5 years or more in space. In the past, coolers for satellites have had lifetimes limited by the rate at which they expended cryogens like liquid nitrogen or by component wear due to friction.

While engineers continue testing the prototype model, they are also building a second, ready-for-space-flight version, which may be completed in two years. Project manager Allan Sherman at NASA's Goddard Space Flight Center and the others involved are planning to test the refrigerator's ability to withstand launch stresses. They also plan to improve the sensitivity of the magnetic sensors and to make the system more efficient. Sherman predicts that future coolers may be able to reach 10 K.

Working toward a quieter helicopter

Many people can identify a helicopter without seeing it because of the distinctive "slapping" sound of its rotor blades. This noise makes military helicopters easily detectable and civilian helicopters a nuisance in populated areas. For many years, helicopter manufacturers have been working to reduce helicopter noise. These efforts have included switching from two-blade to four-blade rotors, modifying or removing the tail rotor, using swept-back blade tips and training pilots to fly helicopters more quietly. Today's helicopters are quieter than those of a few years ago, but more work is needed.

Research also continues on understanding the physics of helicopter rotor noise. As a helicopter's rotor spins, it generates lift. At the same time, the blades shed vortices that, in the simplest case, tend to stay within the rotor's plane. The "slapping" noise arises from the interaction of a blade with the vortex left in the air by the preceding blade. To understand the interaction researchers must be able to measure the shear stresses at the surface of a helicopter blade while it is moving.

Recently, Wesley L. Harris and James Hubbard of the Massachusetts Institute of Technology reported the development of new instrumentation to measure blade surface effects without interfering with the motion of the rotor or the flow of air past the blades. Their technique allows them to pick up an amplified electrical signal that represents what happens in the thin boundary layer of air that sweeps over the blade. Previously, researchers could not easily monitor the stirring up of boundary layer air within thousandths of an inch of a blade's surface.

Harris is excited that his technique may also be applicable to studying a wide variety of rotating systems like wind turbines, compressors and other machinery.

BIOMEDICINE

How electrical healing works

During the past decade, the experimental use of electricity to heal bone fractures has evolved into a significant clinical success (SN: 2/20/82, p. 119). But how does electricity heal fractures? One answer appears to have been found by Richard A. Luben of the University of California at Riverside and colleagues and is reported in the July PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES: It keeps parathyroid hormone from binding to fracture bone cells.

Luben and his team cultured bone cells, then exposed some of them to electromagnetic fields that are effective in healing bones and had others serve as control cells. Parathyroid hormone was then put in the presence of all of the cells. It acted on the control cells, but not on those that had been exposed to the fields.

Parathyroid hormone is known to destroy bony tissue. One way that electricity heals fractures may be by keeping the hormone from acting on cells at the fracture site, thus increasing bone formation.

Thymic hormones: Still another source

Scientists used to think that thymic hormones were made exclusively by the thymus gland and that their main mission was to assist the thymus in the processing of bone marrow cells into T cells — major fighters of the body's immune system (SN: 1/26/80, p. 61). But the role of thymic hormones seems to be broader. Last year California and Washington scientists reported that two thymic hormones — thymosin beta four and thymosin five — influenced hormones of the reproductive system (SN: 11/14/81, p. 311). And now Gen-Jun Xu and colleagues at the Roche Institute of Molecular Biology in Nutley, N.J., have found that thymosin beta four is also manufactured by macrophages — major cells of the immune system in addition to T cells.

Senility: The family impact

Senile dementia affects some three million Americans and is increasing in frequency. Most senile patients are cared for by family members, not by institutions. Peter V. Rabin and colleagues at Johns Hopkins University School of Medicine in Baltimore attempted to determine the impact of the disease on family members who care for senile patients.

As they report in the July 16 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, patient behaviors that produce hardships on family members include memory loss, anger over inability to carry out various tasks, night waking, suspiciousness and difficulties communicating. Family members themselves often suffer from anger and depression over their loved ones' disease and from fatigue from having to care for them.

Fetal activity and age

As human fetuses mature their patterns of activity change, Le Roy J. Dierker Jr. and colleagues at Case Western Reserve University report in the July OBSTETRICS AND GYNECOLOGY.

The Cleveland researchers studied the patterns of activity of two groups of fetuses — one 28 weeks to 30 weeks old and the other 38 weeks to 40 weeks old. They did this by monitoring the fetuses' heartbeats and physical movements since it is known that so many heartbeats or movements over a particular time span indicates whether a fetus is active or not. The younger fetuses, the researchers found, showed active periods averaging 10.3 minutes in length and quiet periods averaging 9.9 minutes in length. The older fetuses, in contrast, showed active periods averaging 35 minutes in length and quiet periods averaging 18.3 minutes in length.