engineering sciences

Gathered at the International Gas Turbine Conference of the American Society of Mechanical Engineers in Brussels, Belgium

RADIAL TURBINES

High-power applications

Most gas turbine engines are axial: the compressed air in them moves in a linear direction. In a radial turbine engine, the air moves peripherally as in a centrifuge. Although the axial turbines are used where large amounts of power are required, R. J. Mowill of A. S. Konigsberg Vopenfabrikk, Norway, says radial engines could be used at the lower end of the high-power spectrum.

His company has developed a 1,600-horsepower radial engine for ships. Reliability and low maintenance costs combined with smallness of size are advantages that make the engine competitive, he says. A key factor in making it more attractive is that the firm has been able to increase the engine's compression ratio.

All of the components in the engine are designed with an eye to cutting down maintenance problems. Sliding bearings are used, for example, to reduce friction and to cope with gyroscopic forces in heavy seas.

ATOMIC ENERGY

Helium turbines for nuclear plants

The conventional working fluids of gas turbines are combustion gases. However, Dr. Wilhelm Endres of Brown Boveri-Sulzer Turbomachinery Ltd., West Germany, sees closed-cycle helium turbines linked to nuclear reactors providing power for 50- to 100-megawatt generators in the near future.

The big problem will be in design so that the turbine and reactor can be joined. Although helium causes no oxidation or corrosion problems, special precautions will have to be taken to prevent leaks and explosions. This involves designing new kinds of valves, ducts and seals. For plants in the 600- to 1,200-megawatt range, safety considerations may prompt the use of a number of smaller turbines in tandem, although one large one may turn out to be the best answer.

Dr. Endres compared helium to air, which he sees as likely to be replaced in closed-cycle turbines by helium because of air's poor heat transfer properties.

GAS TURBINES

Carbon dioxide for geothermal steam

Large quantities of heated underground water remain mostly untapped in many places (SN: 2/1/69, p. 113). A. V. Pradhan of the Borg-Warner Corp. in Bedford, Ohio, suggests that this geothermal energy released as steam could power a gas turbine plant.

He concludes from his studies that carbon dioxide, because it has a low critical temperature—the temperature above which it stays a gas regardless of pressure—would be the best gas to drive the turbine in a closed-cycle system. Such a system could operate on steam coming out of the ground at 300 degrees F. Conventional turbines driven directly by steam require much higher temperatures. All the design and control problems could be solved for a 2,000-kilowatt generator, he believes.

Carbon dioxide won out as the fluid of choice over such competitors as Freon 12, methane, ethane and ethylene.

AUTOMOBILES

Ceramic turbine engine

The gas turbine has been considered a challenger to the internal combustion engine in cars (SN: 12/21/68, p. 617). Auto engineers say that one way to make it competitive is to make it out of ceramics, which would permit higher turbine operating temperatures and therefore greater efficiency and fuel savings. Such a turbine would also be cheaper.

Arthur F. McLean of the Ford Motor Co. sees silicon carbide and silicon nitride as prime candidates. Although these dense, low-cost materials show great heat and corrosion resistance, one drawback is that they can be brittle. This problem can be overcome, says McLean, by unique design to support ceramic components with metal housing.

NAVIGATION

Automated ship system

Pratt & Whitney Aircraft Co. of Hartford, Conn., and AEG-Telefunken of Hamburg, West Germany, have designed an automatic propulsion control system for gas turbines on ships. All the operator need do is select the desired direction and speed of the vessel. The system takes over from there, making all the necessary adjustments, which include varying the speed of the turbines, the pitch of the ship's propeller and the fuel flow.

Heart of the system is a central data-processing unit that links up various automatic control devices. Each device controls some aspect of the turbine's operation. The inputs from the devices are fed into the central processor, which coordinates them.

COMPOSITES

Guides for graphite fibers

Although graphite fibers are a promising engineering material (SN: 6/21/69, p. 601), they are a composite substance and so have a propensity to shear. The problem is caused by the fact that the fibers and matrix in which they are embedded cool at different rates, with resultant improper bonding.

Tests by W. E. Winters of TRW, Inc., of Cleveland, Ohio, have produced some general rules that permit materials scientists to determine how much shear stress is likely to occur in the fibers. After examining the characteristics of various fibers, resins and designs for compositing, he concludes that the factors to consider are the structure, strength and bondage characteristics of the resin, the fiber used and processing conditions.