Hope From a Hot Little Motor

Two U.S. companies striving to make electrical equipment using high-temperature superconducting wire have run into a brick wall—and they're celebrating.

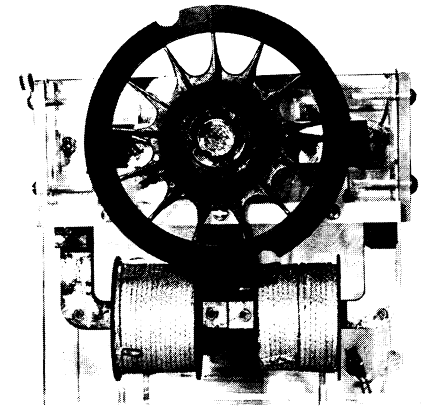
Ever since the discovery of high-temperature superconductors (HTSCs), the applications types have been struggling to make something of these novel substances. Two of the biggest drawbacks have been their brittleness and the frustrating inability of big samples to carry large electrical currents. Enter a group of bismuth compounds—which also contain various proportions of strontium, calcium, copper, oxygen, and in some cases lead—whose grains form an overlapping stack, resembling a microscopic brick wall. These brick walls just might be what has enabled corporate researchers to build a working prototype of a superconducting electric motor.

Built by Reliance Electric Co. in Cleveland, Ohio, the motor's encouraging performance was announced on Monday by the American Superconductor Corp. (ASC) in Watertown, Massachusetts, which makes the flexible superconducting wire used to wind the motor's coils. "To our knowledge, this is the first time anyone has built a superconducting motor using high-temperature superconducting coils that produce a usable power output," ASC president Gregory Yurek noted in a written statement.

"Usable" in this case means only 25 watts of power, just enough to spin a small fan. What's more, the wires aren't quite good enough to warrant commercializing the motor, according to Howard Jordan, manager of research and development at Reliance. But as a demonstration of the flexibility and current-carrying ability of HTSC wires, Yurek told *Science*, the development brightens the prospects for some highly touted large-scale applications such as electrical transmission lines and power storage systems. Frank Fradin, manager of superconductivity research at Argonne National Laboratory, concurs: "The materials look quite nice for a number of those applications." But Fradin adds that real world roles won't come overnight.

If nothing else, the motor is sure to draw yet more attention to the potential of bismuth-containing HTSCs. Until researchers at Siemens in Germany first saw tantalizing current-carrying abilities in this class of compounds about 2 years ago, bulk HTSC materials seemed doomed to suffer from what is known as the "weak-link problem": poor electrical linkage between individual crystal grains. But in the bismuth compounds, the brick walls of grains seem to permit current to find its way through by weaving across the aligned grain boundaries.

Not that ASC could harness this effect to make a wire fit for winding into motor coils without further processing steps. One was sheathing the bismuth compound in silver. ASC isn't revealing more details, but that won't keep other HTSC researchers from coming up with further practical demonstrations of the compounds' potential. Says Roger Poeppel, senior engineer at Argonne and director of the lab's HTSC pilot center: "There has been steady progress," especially in the United States, Germany, and Japan. "I'd say there's a lot of optimism." ■ IVAN AMATO



Tony Dejak for American Superconductor

Motor of the future? *When immersed in liquid nitrogen, two coils made of flexible high-temperature superconducting wires provide enough power to spin the fan.*

Thumbs Up for Two Detectors

The experimental program for the Superconducting Super Collider (SSC), in flux since laboratory director Roy Schwitters canceled one of the accelerator's two planned main detectors, seems back on track. The laboratory's rejection of the L* detector (*Science*, 17 May, p. 908) had raised the alarming possibility that the $8.2-billion machine would be left with only a single major detector. But the laboratory's Program Advisory Committee, which advises Schwitters on experimental matters, concluded 2 weeks ago that efforts to put together an alternative to L* look promising enough to receive "appropriate [financial] support." And early this week Schwitters said he will adopt the committee's recommendations "as written."

The expert panel—chaired by physicist Jack Sandweiss of Yale—gave its stamp of approval to a new collaboration working to fill the gap left by L*'s demise. Since its formation last June (*Science*, 21 June, p. 1610), the team has formally elected California Institute of Technology physicist Barry Barish and Columbia University physicist Bill Willis as cospokesmen; named itself GEM (for Gammas, Electron, and Muon detection); and signed up 300 members from more than 50 institutions, including several Soviet groups and smaller teams from Korea, Romania, Germany, China, Japan, Brazil, and India.

Progress toward a design has been somewhat slower, as expected: While the GEM collaboration has agreed to build its detector with a large toroidal superconducting magnet, the team expects to continue researching and comparing technologies for detector subsystems such as calorimetry and particle tracking for several months.

Schwitters says he intends to approve about $500,000 for GEM through November, when the group must submit an official letter of intent that will spell out the detector's proposed design, cost, and capabilities in detail.

As presented to the SSC advisory committee earlier this month, GEM is expected to cost between $439 million and $498 million. That estimate will certainly be heavily scrutinized once the design firms up, because staying within the SSC Laboratory's limited budget for detector design is one of the chief obstacles faced by both GEM and the Solenoidal Detector Collaboration, the detector approved early this year. Indeed, even as it was approving GEM, the advisory panel was rapping the knuckles of the Solenoidal Detector team. That group was proud of having "descoped" its $712-million design to one costing $595 million—but, noted the advisory group, that figure was still $95 million over the budget set by Schwitters. "It is unlikely that the funds available for construction of the [Solenoidal Detector] will match the current cost estimate," states the panel's report. Instead, it suggested that the Solenoidal Detector team consider eliminating some detector subsystems and reducing the capabilities of others in order to meet its budget.

On the other hand, the advisory committee was effusive in praising the GEM collaboration, noting its "impressive progress" in forming a "strong team with a prospect of increased international participation." Schwitters, however, warns the team not to get complacent: "The first report was good and very promising, but it was clearly the result of a few weeks effort. It needs to get stronger." ■ DAVID P. HAMILTON