The Curly Cooker

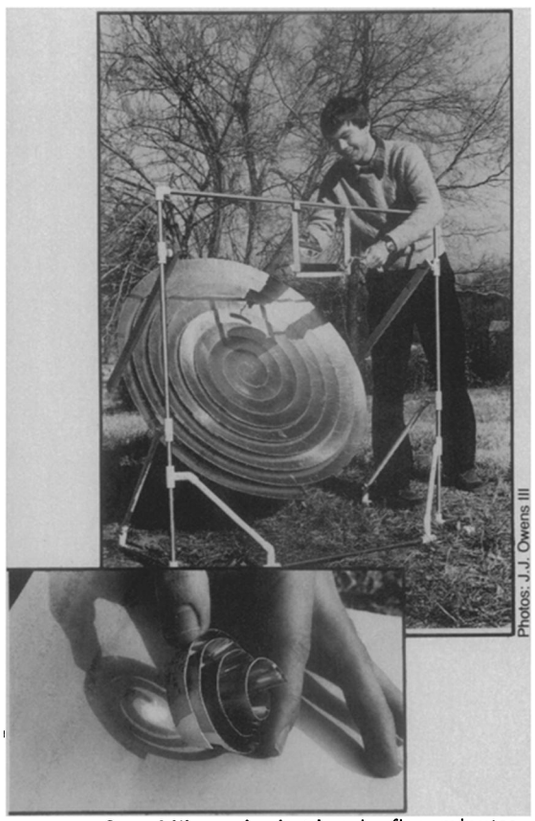
Developers of a simple, low-cost solar concentrator appear to be headed down the road to success

BY JANET RALOFF

Anodized aluminum 500-sun concentrator ignites stick within two seconds.

What's cookin' in Mali? J.D. Walton is hardly a gourmet chef of the local Sudanese fare, but beginning this week, he'll be imparting a new twist — coil, actually — to the preparation of native cuisine. It's part of an experiment to test the appropriateness of a simple, low-cost solar cooker. More important, this road show may refine engineering details for the first commercial application of a novel solar concentrator.

At the heart of the solar cooker is a spiral, Fresnel concentrator, the brainchild of Richard Steenblik. He developed its conceptual design three and a half years ago while a mechanical engineering student at the Georgia Institute of Technology. Steenblik is still at Georgia Tech but, like Walton, he's now a research engineer in the solar-energy branch of its Engineering Experiment Station.



Photos: J.J. Owens III

Steenblik cooks hotdog in five minutes over 50-sun cooker (above). Walton patterned its frame off design used in Upper Volta. Its grill is readjusted every 15 minutes for sun's movement. Negative-focal length model (below).

Steenblik's concentrator is made by slightly coiling a spiral cut from a rigid, flat sheet. Nearly any material will do — from steel or masonite to cardboard or glass. Then it's mounted on a rigid planar frame with clips or tacks to achieve the desired focusing strength. Depending on the application or desired temperature, concentration can be varied from 0 to 2,000 times the incident solar energy.

But watch the fingers. A 50-sun concentrator tested in Atlanta this spring achieved 420°F at its focus in early morning, 600°F at noon. And the theoretical focal temperature for a unit offering 500-suns concentration is 2,500°F.

With a positive focal length, the hot spot appears above the spiral — depending on concentration, one or more inches in diameter. By design, the coil can provide a hollow, uniform or peaked heat distribution at its focus. A negative focal length can be achieved as easily, moving the hot spot behind. Concentrators can even be engineered to provide many foci — like a multi-burner stove — or to simulate the performance of hyperbolic and elliptical concentrators.

Construction is easy. If the material from which the spiral will be made is reflective, a pattern (see cover illustration) is simply laid atop it and a continuous cut sawed along the line. If it is not reflective, aluminum foil or another reflective covering is pasted to its surface before laying the pattern down. Mounting points are indicated on the pattern; when aligned in straight lines and attached to a frame, the surface of each spiral band becomes canted to focus sunlight at a common point.

Steenblik found that the hard part was determining the number of bands and mounting points necessary to make a spiral provide a desired magnification. That is computerized now, as is even the printing of customized patterns.

"Using materials available in this country, bought at retail prices, the cooker alone costs less than four dollars," Steenblik told SCIENCE NEWS. And that low cost, together with simplicity, "gives us great hopes that this solar cooker design will be accepted in the poor villages where it is so badly needed."

Appropriate technologies must reflect local needs and practices to be accepted. It is also important that local people can build and service cookers. After all, Steenblik said, "If a water buffalo stomps on it, you have to know somebody can fix it." And that's why Walton went to Mali. He will observe how well local craftsmen assemble cookers with indigenous materials. And he will collect ideas for design modifications from cooks and other would-be users.

Under a program to encourage innovation and to transfer resulting technologies into the real world, Georgia Tech is patenting Steenblik's concentrator and will give him 50 percent of all royalties.

But the concentrator's success probably won't rest on the solar cooker's popularity alone. In recent weeks, Steenblik has received technical inquiries from petrochemical-equipment manufacturers, photovoltaic designers, engineering consultants, the 3M Co. and a group conducting high-temperature tests of missile components. Steenblik has even started a mail-order business in which $6 buys do-it-yourself cooker patterns. And coming up — patterns for the camper's solar cooker. □