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8. Metal Membrane Concentrators for Solar Power Plants (Saudi Arabia)

Client:	*Saudi Arabian National Centre for Science and Technology (SANCST), Riyadh*
	Federal Ministry of Research and Technology (BMFT), Bonn
Development and Project Management:	*Schlaich und Partner, Stuttgart*
Contractors:	*Lipp GmbH, Tannhausen,*
	United Stirling AB, Malmoe
	MBB Messerschmidt-Bölkow-Blohm AG, Ottobrunn

As a means of generating electricity from solar energy, high-temperature energy conversion with concentrating systems has a very promising future.

A large hollow reflector is suspended and supported on rails in such a way that it can track the sun. The reflector has an energy converter, which converts the concentrated solar heat into electricity, suspended at its focal point (Fig. 1).

The new and special feature of the power plant described here is the construction method for the concentrator, which makes very large diameters possible. The concentrator is a hollow membrane of thin sheet steel to which mirror glass is bonded.

Fig. 2: Welding of the Membrane

The sheets are welded from coiled strips, only 0,5 mm thick, by a special welding fractor, which produces gas-tight welds of the same stiffness as the parent material (Fig. 2). The circular membrane (Fig. 3) is attached to the stiffening ring and the whole unit turned (Fig. 4) to fix the second sheet of the 'drum'. The membranes are then plastically deformed to the desired shape by air pressure (Fig. 5). When the concentrator is in operation the shape of the membranes is kept constant by a partial vacuum in the concentrator interior.

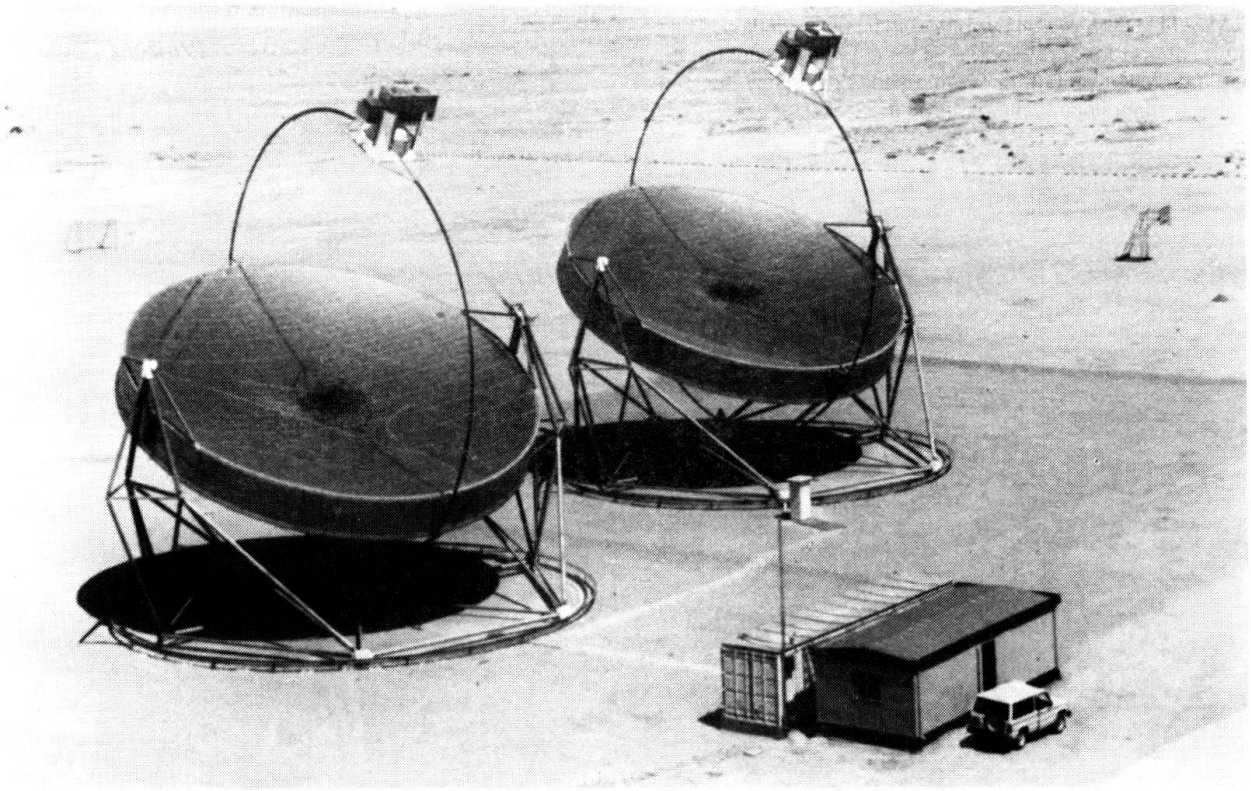

Fig. 1: 2 Metal Membrane Concentrators with Stirling Engines for a Research Power Plant in Riyadh, Saudi Arabia

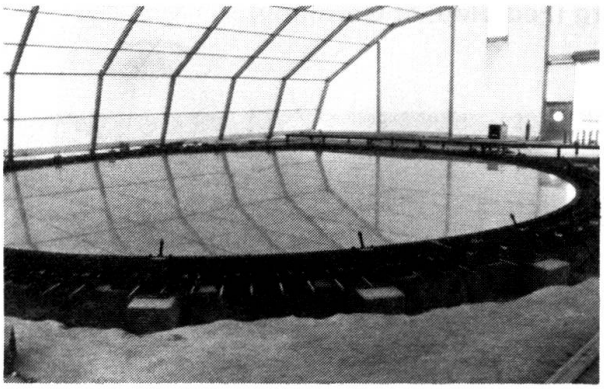

Fig. 3: Welded and prestretched Membrane

The two concentrators in the solar research station in Riyadh have a diameter of 17 m, i.e. a concentrator area of 227 m. Their average concentration factor is 600; this figure, which directly mirrors the uniformity and accuracy of the welding and shaping of the membranes, could even be increased up to 900 – 1000 in the future.

The concentrators and their support structure are designed for a wind speed of 50 km/h while generating and 80 km/h while the concentrators are still moving.

The prototypes in Riyadh are in operation now since the end of 1985. They produce up to 40 kW each with a solar radiation of about 1000 W/m^2; the concentrators have not shown any problem during performance.

With its simple technology yet nevertheless high accuracy, on which the output of the energy converter and thus the whole plant mainly depends, the membrane concentrator presents a decisive improvement in the development of highly concentrating solar power plant systems. Further the prospect of its application for antenna structures is also promising with these properties.

(R. Bergermann)

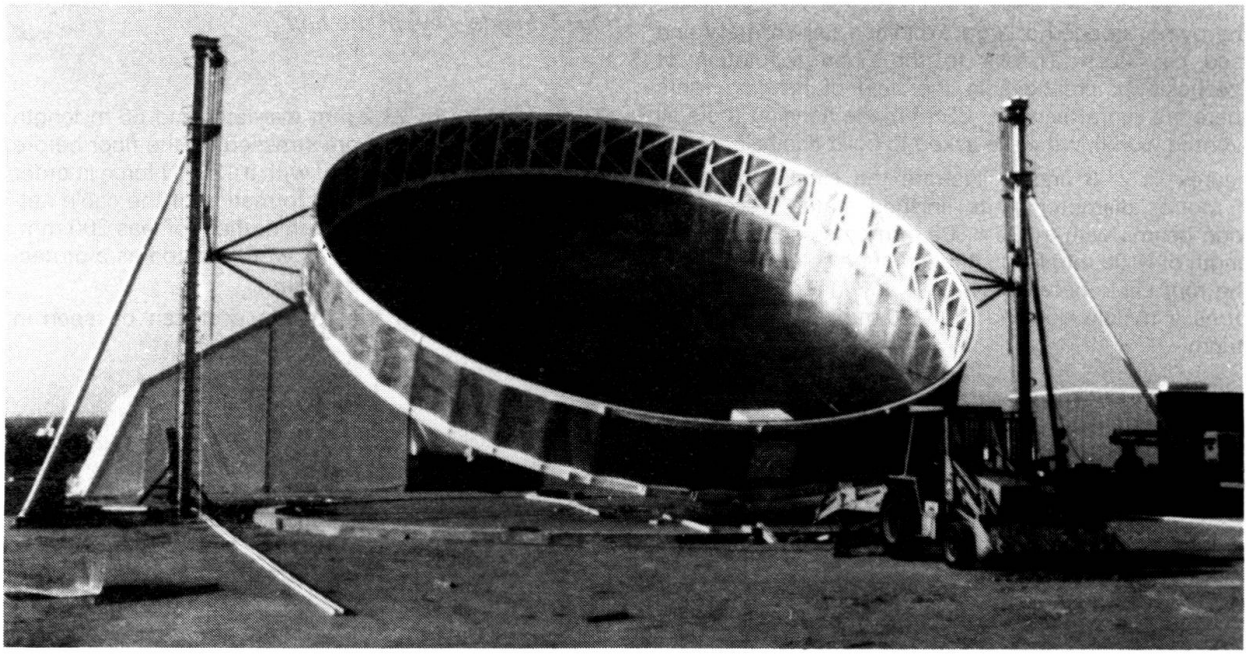

Fig. 4: Concentrator during Construction

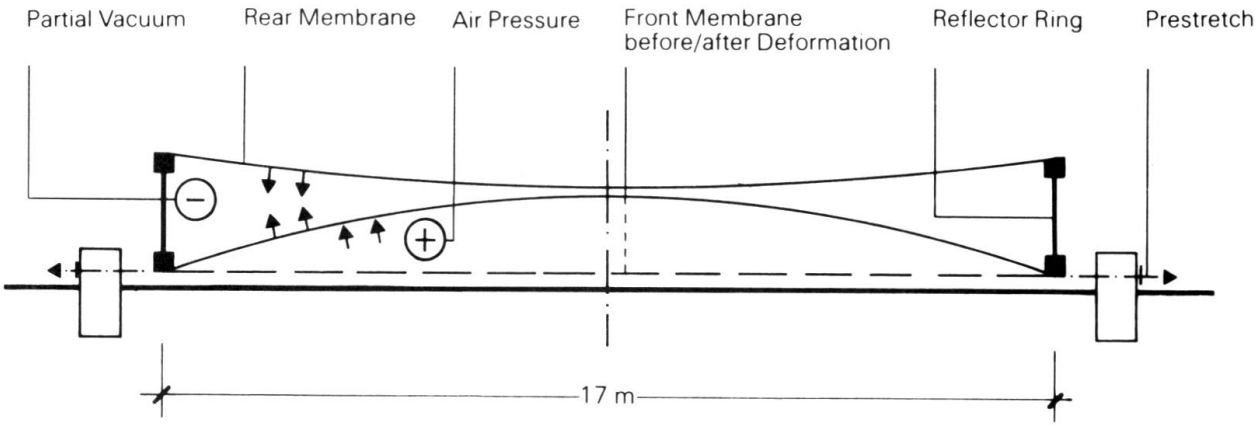

Fig. 5: Concept of the Membrane Shaping Operation