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Diver

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(54) **ALIGNMENT METHOD FOR PARABOLIC TROUGH SOLAR CONCENTRATORS**

(75) Inventor: **Richard B. Diver**, Albuquerque, NM (US)

(73) Assignee: **Sandia Corporation**, Albuquerque, NM (US)

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(58) **Field of Classification Search** 356/152.2, 356/138; 136/246; 126/602; 372/9
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,242,580	A *	12/1980	Kaplow et al.	.....	250/203.4
5,269,288	A *	12/1993	Stirbl et al.	.....	126/593
5,982,481	A *	11/1999	Stone et al.	.....	356/152.2
6,225,551	B1 *	5/2001	Lewandowski et al.	.....	136/246
6,597,709	B1	7/2003	Diver, Jr.		
7,569,764	B2 *	8/2009	Shan et al.	.....	136/246

OTHER PUBLICATIONS

Richard L Wood, "Distant Observer Techniques for Verification of Solar Concentrator Optical Geometry", Solar Energy Research Institute, 1981, UCRL-53220.

M.K. Selcuk, "Parabolic Dish Test Site: History and Operating Experience", Prepared for USDOE through NASA by Jet Propulsion Laboratory, JPL Publication 85-18. Feb. 15, 1985.

F. R. Livingston, "Activity and Accomplishments in Dish/Stirling electric Power System Development," Prepared for USDOE through NASA by Jet Propulsion Laboratory, JPL Publication 85-8. Feb. 15, 1985.

T. Wendelin, "Parabolic Trough Optical Characterization at the National Renewable Energy Laboratory," DOE/Solar Program Review Meeting, 2004, DOE/GO-102055-2067, pp. 328-329.

Eckhard Lupfert et al, "Parabolic Trough Analysis and Enhancement Techniques," Proceedings of ISEC2005, 2005 International Solar Energy Conference, Orlando, FL, pp. 1-7.

Hank Price et al, "Advances in Parabolic Trough Solar Power Technology," Journal of Solar Energy Engineering, May 2002 vol. 124 pp. 109-125.

(Continued)

Primary Examiner—Tarifur R. Chowdhury

Assistant Examiner—Isiaka O Akanbi

(74) *Attorney, Agent, or Firm*—Kevin W. Bieg

(57) **ABSTRACT**

A Theoretical Overlay Photographic (TOP) alignment method uses the overlay of a theoretical projected image of a perfectly aligned concentrator on a photographic image of the concentrator to align the mirror facets of a parabolic trough solar concentrator. The alignment method is practical and straightforward, and inherently aligns the mirror facets to the receiver. When integrated with clinometer measurements for which gravity and mechanical drag effects have been accounted for and which are made in a manner and location consistent with the alignment method, all of the mirrors on a common drive can be aligned and optimized for any concentrator orientation.

20 Claims, 6 Drawing Sheets

