In the United States Court of Federal Claims

No. 14-147C
(Filed: February 9, 2018)

PROBIR K. BONDYOPADHYAY,	*	**Patent Infringement; 28 U.S.C. § 1498; Summary Judgment; Direct Infringement; Doctrine of Equivalents; Insubstantial Differences; Triple Identity Test.**
Plaintiff,	*	
v.	*	
THE UNITED STATES,	*	
Defendant.	*	

Probir K. Bondyopadhay, Ph.D., Houston, TX, pro se.

Benjamin C. Mizer, Gary Hausken, and Alice Suh Jou, U.S. Department of Justice, Civil Division, Commercial Litigation Branch, Intellectual Property Staff, P.O. Box 480, Ben Franklin Station, Washington, D.C. 20044, for Defendant.

OPINION AND ORDER

WILLIAMS, Judge.

In this action, Plaintiff pro se Dr. Probir K. Bondyopadhyay,[1] the inventor of United States Patent No. 6,292,134 ("the '134 Patent") for a "Geodesic Sphere Phased Array Antenna System," claims that the United States Air Force ("Air Force") infringed Claims 14, 25 and 26 of his patent

[1] Dr. Bondyopadhyay received a Ph.D. in electrical engineering from Polytechnic University of Brooklyn in 1983, and taught electrical engineering and computer science at both New York Institute of Technology and Maritime College. Tr. 7, 11.

by using and manufacturing a portion of a phased antenna array system.[2] This matter comes before the Court on Defendant's motion for summary judgment.[3]

Background[4]

The '134 Patent

The '134 Patent was issued on September 18, 2001, to Plaintiff, inventor Dr. Probir K. Bondyopadhyay, from Application No. 09/513,014 ("the '014 Application") on February 25, 2000. The '014 Application claims priority to provisional Application No. 60/121,874 filed on February 26, 1999. The '134 Patent consists of 30 claims - - independent Claims 1, 14, 19, and 25, and dependent Claims 2-13, 15-18, 20-24, and 26-30. Plaintiff asserts that the Air Force infringes Claims 14, 25, and 26 of the '134 Patent.[5]

Claim 14 is illustrative of the invention:

> 14. A geodesic sphere phased array antenna system for multi-satellite communications and tracking, said antenna system comprising:
>
> a geodesic structure derived from a truncated icosahedron having twelve pentagonal and twenty hexagonal planar faces, a plurality of said geodesic planar surfaces each having mounted thereon a subarray of planar antenna element units;

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[2] In his infringement contentions, Plaintiff also asserts infringement of Claims 1, 2, 4, 5, 7, and 10 based on an Air Force Research Laboratory Report published in September 2004, that, according to Plaintiff, details "the design manufacturing and successful testing of a hexagonal subarray unit of the Geodesic Structure based on the regular icosahedron." Pl.'s Infringement Br. 4. However, this Court already dismissed Plaintiff's claims of infringement "prior to January 11, 2008" as time-barred under this Court's six-year statute of limitations, 28 U.S.C. § 2501 (2016); Bondyopadhyay v. United States, No. 14-147C, 2015 WL 1311726, at *5 (Fed. Cl. Mar. 20, 2015). As this Air Force Report was published in 2004, Plaintiff's claims of infringement based on the Air Force's activity detailed in this report are time-barred and dismissed. Id. ("Any claims prior to January 11, 2008, are time-barred and dismissed.").

[3] In ruling on summary judgment, the Court has considered Plaintiff's "Motion for Leave of the Court" docketed as Plaintiff's "Motion of the Infringement Phase." (ECF No. 216).

[4] This background is derived from the '134 Patent as well as the appendices attached to the parties' motion papers. This Court's opinions on claim construction and Defendant's partial motion to dismiss provide additional background. See Bondyophadyay v. United States, 129 Fed. Cl. 793, 795-800 (2017); Bondyophadhyay, 2015 WL 1311726, at *5. Citations to Tr. are to the Court's September 28, 2016 claim construction hearing. "GA" refers to the appendix to Defendant's motion for summary judgment.

[5] In his "Claims Infringement Brief," filed on March 20, 2017, following the Court's September 28, 2016 claim construction hearing, Plaintiff limits his claims of infringement to Claims 14, 25, and 26. Pl.'s Infringement Br. 4 ("This work infringed upon Claims 14, 25 and 26 of the Plaintiff's U.S. Patent 6,292,134.").

transmit and receive signal processing means connected to each said planar antenna element unit of each said subarray for simultaneous transmission and reception of signals;

electromagnetic signal feed means connected to each said planar antenna element unit of each said subarray for forming at least one electromagnetic beam in space;

electronic switching means for selectively connecting each said planar antenna element unit of said subarrays to adjacent planar antenna element unit of said subarray or adjacent subarrays for generating multiple electromagnetic beams in selective diverse directions in space;

electronic phase shifting means connected to each said planar antenna element of each said subarray for providing electronic scanning capability to said subarrays of antenna element units connected by said electronic switching means with the phased array communication space being segmented into a plurality of smaller cellular spaces,

each said cellular communication space for electronic scanning being defined by a plurality of discrete chosen directions corresponding to the said geodesic sphere phased array structure and, each said cellular communication space adapted to be electronically scanned by a plurality of active said contiguous phased subarrays corresponding to the said cellular communication space.

'134 Patent 12:65-13:37.

Overview of the Invention

The invention of the '134 Patent is directed to a "geodesic sphere phased array antenna system," used for satellite communications. '134 Patent Abstract. A geodesic sphere phased array antenna system consists of a geodesic sphere with a phased antenna array mounted onto its planar surfaces. A geodesic sphere is a collection of multiple flat planes of various shapes such as triangles, pentagons and hexagons in which the edges of the planes are contiguously linked together to form a sphere. '134 Patent 4:2-6. 5:27-30, 6:4-9. A soccer ball and Disney's Epcot Center's Spaceship Earth "golf ball" are well known examples of geodesic spheres.

A phased array antenna system is a collection of smaller antenna elements that work in a synchronized fashion to create a stronger communication signal than a single antenna alone by harmonizing the signals of multiple smaller antennas. This is accomplished by aligning the "phases" of the smaller antennas - - i.e., the sinusoidal curves that send a communication signal - - which increases the amplitude of that signal. '134 Patent 1:51-57; Haupt Decl. ¶ 31-32 (Aug. 16, 2016). To align these sinusoidal curves, the antennas in the array are connected by a "feed structure" that energizes, or "feeds," electromagnetic signals to each of the individual antennas in the array. '134 Patent 1:51-57.

Figure 1 of the '134 Patent illustrates the invention and depicts a planar triangle 22 studded with a subarray of antenna elements which, when contiguously linked together, form the geodesic sphere structure:

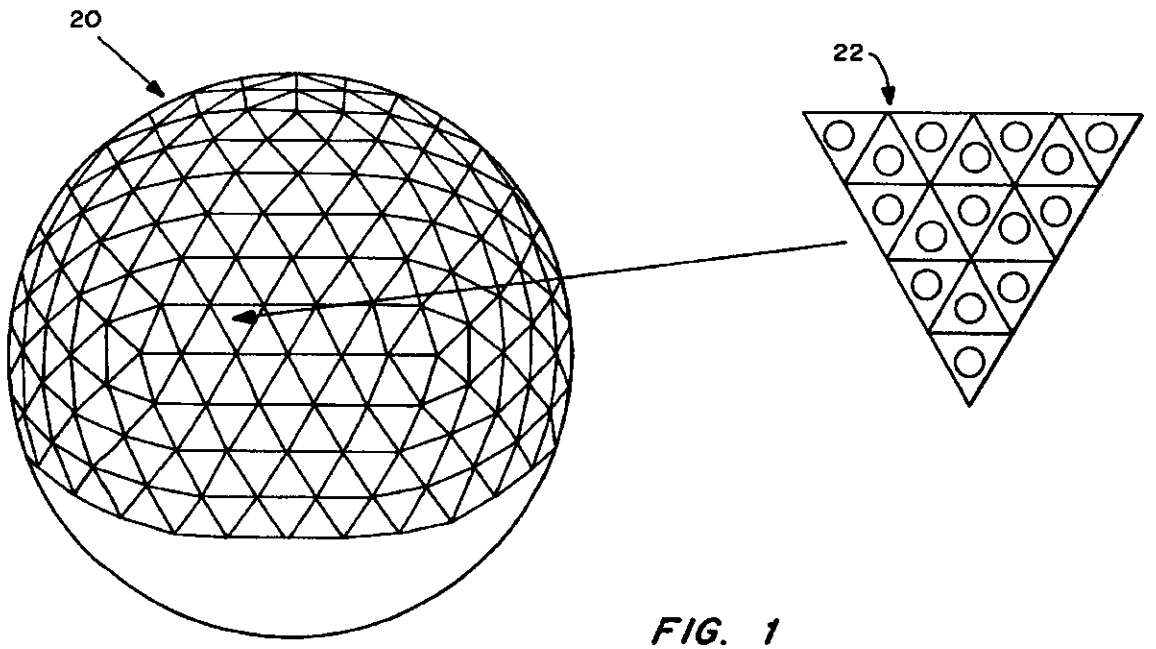


FIG. 1

'134 Patent Fig. 1, 4:46-52 ("FIG. 1 is an exploded view showing a phased array antenna of the present invention which comprises substantially equilateral triangular-shaped subarrays of antenna elements mounted on the faces of a geodesic sphere structure with one of the triangular subarrays broken away and enlarged for purposes of illustration . . . .").

The "main objective" of the '134 Patent was to create a "low cost phased array antenna architecture that will provide communication coverage over the entire hemisphere." '134 Patent 3:49-52. According to the '134 Patent:

> The most important aspect of this invention is the cellular scanning idea wherein the energized portion of the phased array, consisting of the appropriate number of contiguous subarrays that sets up an electromagnetic beam in a given direction, changes with the direction of the beam. The key point of the invention is to limit the electronic scanning requirement for any of these beams to a cellular communication space which in a preferred configuration, could be bounded and defined by the adjacent vertices of the geodesic sphere. The geodesic sphere phased array antenna may be so constructed that this scanning requirement is less than 10° off broadside within a conical scanning space.

Id. at 10:17-28.

In other words, the invention calls for an increased number of planar surfaces with phased array antenna elements to be mounted onto the geodesic sphere. This increase in planar surfaces

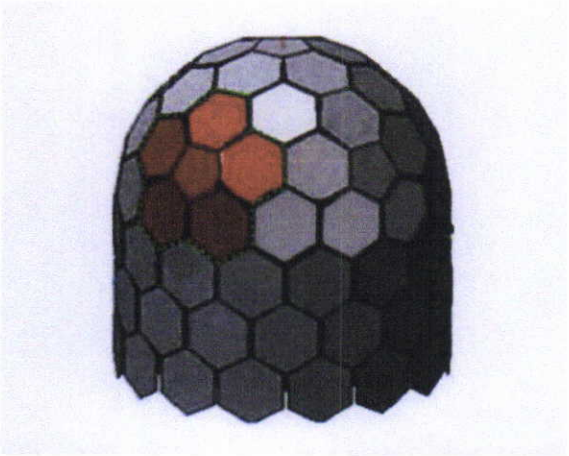
permits communication signals to be sent and received from multiple locations simultaneously along the sphere's surface. '134 Patent 4:15-26; Haupt Decl. ¶ 35 (Aug. 16, 2016). In addition, the greater number of planar surfaces divides the hemispheric communication space into smaller "cellular communication spaces," thus limiting the area that a subarray of antenna elements must scan to transmit and receive signals to "less than 10° off broadside within a conical scanning space." '134 Patent 10:21-28. As a result, a given communication signal from the invention described in the '134 Patent would be stronger and more precise than an antenna that must scan at wider angles to transmit and receive communication signals.

The Accused Product

There is only one accused device at issue - - the Ball Advanced Technology Demonstration antenna. Since at least 2000, the Air Force Research Laboratory was interested in the feasibility of a large antenna system called the Geodesic Dome Phased Array Antenna. As part of this research, the Air Force sponsored a number of small businesses to research and develop technology required for building a full-scale Geodesic Dome Phased Array Antenna. Subsequently, in November 2006, the Air Force awarded a contract to Ball Aerospace & Technologies Corporation to develop a Geodesic Dome Phased Array Antenna advanced technology demonstration. GA043. Accordingly, Ball was "to develop, build, and demonstrate the technological maturity, manufacturing readiness, and mission effectiveness of a scalable sector" of a Geodesic Dome Phased Array Antenna. GA030. The Ball Advanced Technology Demonstration antenna was the result of this research and development.

The Ball Advanced Technology Demonstration antenna was designed in 2006-07, manufactured in 2007-08, and installed at Schriever Air Force Base in Colorado in 2008-09, for testing and demonstration. The actual demonstration of the Ball Advanced Technology Demonstration antenna took place between February 2009 and May 2009.

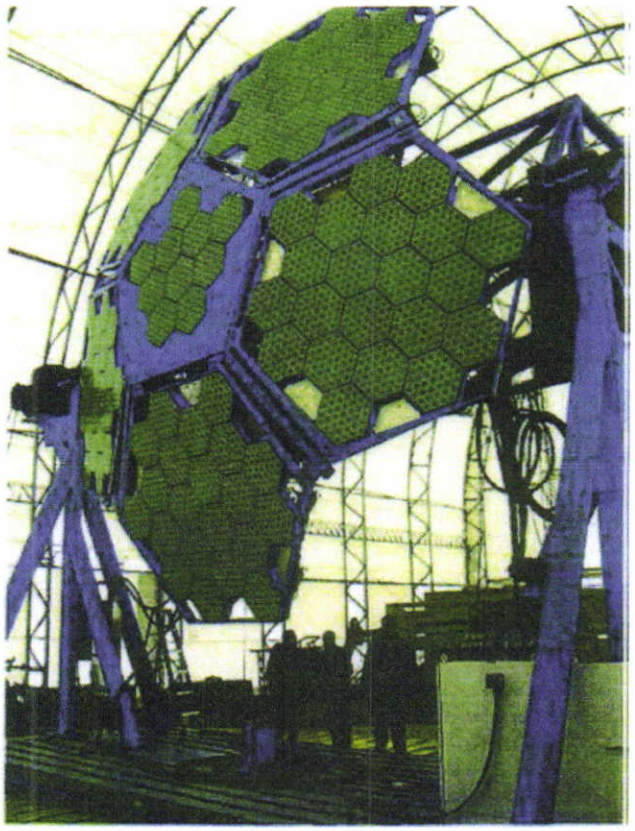
The Ball Advanced Technology Demonstration antenna, which stood roughly one to two stories high, was not completely constructed to constitute a full sphere, and was only made up of six flat panels: a single central pentagonal-shaped panel, surrounded by five outer hexagonal-shaped panels. Def.'s Mot. 7. The figure below depicts the Ball Advanced Technology Demonstration antenna constructed by the Air Force:



GA202 (Ball Final Report (US-000151) Fig. 28.

As explained by Dr. Haupt,[6] Defendant's expert, this figure shows the six panels that constitute the Ball Advanced Technology Demonstration antenna array. In Dr. Haupt's opinion, and, as is obvious from the figure, these six panels are a very small fraction of the array panels of a full Geodesic Dome Phased Array Antenna. Haupt Decl. ¶ 10 (Aug. 17, 2017). The Ball Advanced Technology Demonstration antenna is not a "sphere" as defined by the Court in its claim construction opinion because it is not greater than a hemisphere, as it only had six panels.

The picture of the Ball Advanced Technology Demonstration antenna appended to the Complaint shows these six panels as follows:



[6] Dr. Randy Haupt is a Professor of Electrical Engineering and Computer Science at the Colorado School of Mines, with 38 years of experience in phased array antennas. He has a Ph.D. in Electrical Engineering from the University of Michigan. In 1993, he was named the Federal Engineer of the Year - - the top engineer employed by the United States Government. He is currently the chair of the Institute of Electrical and Electronics Engineers ("IEEE") Antennas and Propagation Society Fellows Committee, and from 1999 to 2014, was a member of the IEEE Antennas Definitions Working Group that defines government and industry terms for antenna specifications. Haupt Decl. ¶¶ 4-11 (Aug. 16, 2016). This Court accepted Dr. Haupt as an expert in the fields of electrical engineering, antenna design, antennas for satellite communications, and phased array antennas. Tr. 103. This Court found Dr. Haupt to be "a well-qualified and credible expert," whose "testimony was clear and helpful to the Court." Order 2 (Nov. 18, 2016).