United States District Court,
E.D. Michigan, Southern Div..

BEI TECHNOLOGIES, INC., a Delaware Corporation, et al,
Plaintiffs/Counter-defendants.
v.
MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD., a Corporation of Japan, et al,
Defendants/Counter-plaintiffs.

Oct. 24, 2002.

Andrew J. Lusk, Gregory M. Kopacz, Dykema Gossett, Bloomfield Hills, MI, for Plaintiffs.

Donald W. Myers, Miller, Canfield, Marjory G. Basile, Detroit, MI, for Defendants.

ORDER ON CLAIM CONSTRUCTION

AVERN COHN**, District Judge.**

I.

This is a patent case involving U.S. Patent No. 4,654,663 ('663) entitled Angular Rate Sensor Systems and described in the ABSTRACT as follows:

An angular rate sensor system is disclosed, consisting of a balanced resonant sensor. The sensor consists of a tuning fork of a piezoelectric material, preferably of quartz. The tines of the tuning fork are caused to vibrate electromechanically, for example, by impressing an alternating voltage on a pair of electrodes on each tine. This will cause the tines to vibrate. Any component of angular motion around the axis of the sensor causes a cyclic deflection of the tines at right angles to the normal driven vibration of the tines. If the rotational input to the handle of the sensor is applied through a torsion element, the resulting tine deflection is directed to cyclically rotate the entire sensor along the input/output axis. This deflection can be used for changing the capacitance of a capacitance bridge, or for generating an electric signal, due to the piezoelectric effect resulting from the deflection. Finally, the output signal may consist of a frequency-modulated signal or an optical pick-up may be used. The system may take various forms, including one, two, four, or eight tuning forks forming a unitary system.

The DETAILED DESCRIPTION (col.6, II.7-28) describes the disclosure of the '663 patent as follows:

There has been disclosed an angular rate sensor comprising basically a tuning fork energized by a drive oscillator. Angular motion of the system will cause a deflection of the output shaft at right angles to the direction of vibration. This deflection can be measured either by a capacitance effect, by a resistive effect, or by an electric voltage generated by the piezoelectric effect. Also, a frequency-modulated output signal may be obtained, or an optical pick-up may be used. Various configurations have been shown providing a

multiplicity of tuning forks. The preferred arrangement permits control of the frequency of the output signal with respect to the vibration of the sensor. Such an angular rate sensor can be manufactured by semiconductor techniques much more inexpensively than a conventional gyroscope. In addition to being less expensive to manufacture, its accuracy should be sufficient for most practical applications, as directional and attitude references with magnetically or gravitationally corrected applications and even for inertial quality references used as a self-contained inertial guidance system.

Plaintiffs BEI Technologies, Inc. and BEI Sensors & Systems Company, Inc. FN1 (collectively, BEI) claiming to be the exclusive licensee of the ' 663 patent are suing defendants Matsushita Electrical Industrial Co., Ltd., Matsushita Electronic Components Co ., Ltd., and Matsushita Electric Corporation of America (collectively, Matsushita) FN2 for infringement in the making, etc ., of quartz rate sensor products and components, and related products and services which fall within the scope of one or more of the claims of the ' 663 patent.

FN1. The role of BEI Sensors & Systems Company, Inc. is not clear.

FN2. The separate roles of defendants in the claimed infringement is not clear.

Angular rate sensors are useful in determining the angular rate of motion in aircraft, spacecraft, ships, missiles, and automobiles, and are a significant improvement over gyroscopes and, in many cases, when miniature size is useful and a gyroscope cannot be utilized.

Because this case will be tried to a jury, liability will be bifurcated from willfulness and damages and the trial initially limited to a single claim, claim 1, which reads:

An angular rate sensor system comprising:

(a) a tuning fork formed from *a single crystal of piezoeletric material,* said tuning fork having two tines and a common shaft disposed in a plane, said *common shaft serving as an output shaft,* said *tuning fork providing a balanced resonant sensor responsive solely to a component of angular motion about the longitudinal axis of the output shaft,* causing a torsional deflection of said output shaft

(b) *driving means coupled to said tines for causing them to vibrate at a drive frequency*

(c) *electrode means,* responsive to piezoelectric signals, *positioned on said tuning fork for sensing said piezoelectric signals representative of the angular rate of motion* about said axis to which said system is subjected and

(d) output means including a phase detector for said piezoelectric signals and means for generating an output signal indicative of the angular rate of motion.

The parties appear to agree that the limitations or elements underlined above (which the Court will call phrases) require construction on the premise that their meaning is ambiguous. These phrases are:

1. a single crystal of piezoelectric material

2. common shaft serving as an output shaft

3. tuning fork providing a balanced resonant sensor responsive solely to a component of angular motion about the longitudinal axis of the output shaft

4. driving means coupled to said tines for causing them to vibrate at a drive frequency

5. electrode means ... positioned on said tuning fork for sensing said piezoelectric signals representative of the angular rate of motion

Additionally, under 35 U.S.C. s. 112 para. 6 *driving means* and *output means* are means-plus-function elements and require identification of the corresponding structure described in the specification. The parties agree that *electrode means* is not a means plus function element.

The parties and the Court have been engaged in a *Markman* FN3 proceeding. Considerable lawyer effort has been expended in the proceeding and an enormous amount of paper has been generated. The parties know more about and are better aware of the consequences of claim construction than is the Court. What follows are the Court's determinations-determinations that are tentative and subject to revision should there be cause to reconsider.

FN3. In Markman v. Westview Instruments, Inc., 517 U.S. 370 (1996), the United States Supreme Court made clear that claim construction is a question of law for the court. *Markman* and subsequent case law set forth the guidelines for claims construction. As such, a hearing on claims construction is known as a *Markman* proceeding. *See* JAMES M. AMEND, PATENT LAW: A PRIMER FOR FEDERAL DISTRICT JUDGES 15-18(1998).

II.

A. A Single Crystal of Piezoelectric Material

1.

This is the most disputed phrase in claim 1. The material from which the sensor is made is critical to its operation. The '663 patent describes it as follows (col.1, ll.42-53):

Preferably but not necessarily, the tuning fork consists of quartz. However, other piezoelectric materials may be used, such as synthetic crystals; for example ethylene diamine tartrate (EDT), dipotassium tartrate (DKT), or ammonium dihydrogen phosphate (ADP). Non-piezoelectric materials may be used with a piezoelectric drive.

Preferably the tuning fork consists of an insulating material such as quartz, but it is also possible to utilize conductive materials, in which case the tines of the tuning fork must be excited electromagnetically; that is, by stationary coils and a magnetic system on the tines.

Neither party made any effort to read its proffered construction on any of these materials. Also, so far as the Court recalls, no effort was made at the tutorial which preceded the *Markman* hearing, or at the hearing itself, to compare the atomic arrangement of these materials to that called for by the phrase in question. Lastly, neither party has made any effort to relate its proffered construction to materials available in the real world, either naturally or grown artificially.

It is undisputed that piezoelectric effect means that an electrical charge is generated if the material is subject to pressure.

This phrase is construed as follows:

A single piece of natural or synthetic piezoelectric or semiconductor material whose atoms are arranged with some degree of geometric regularity and which produces a relatively stable output signal when mechanical force is applied.FN4

FN4. Matsushita has argued for several different constructions of this phrase. Initially, Matsushita took the position that the proper construction of this phrase is as follows:
An undivided and only one, homogeneous solid of piezoelectric material throughout which all the atoms or molecules are arranged in a regularly repeating pattern having the same crystallographic orientation.

Matsushita then argued for the following construction:
a solitary, unaccompanied, homogeneous solid of piezoelectric material formed by a repeating three-dimensional pattern of atoms, ions, or molecules and having fixed distance between constituent parts, in which all parts have the same crystallographic orientation.

Most recently, Matsushita argued that the phrase be construed as follows:
A single piece of a natural or synthetic piezoelectric material whose atoms are arranged with substantially consistent geometric regularity and substantially consistent crystallographic orientation.

This construction is consistent with scientific dictionary definition FN5 of crystal and distinguishes the material from which the tuning fork is made from the material called for in the relevant prior art, particularly U.S. Patent Nos. 3,141,100; 3,206,986; and 3,258,617.

FN5. At the Court's request by letter dated August 5, 2002, the parties submitted a glossary of terms. They differ on the meaning of the word "crystal." The following are their respective definitions of "crystal", "crystalline material" and "crystallographic orientation".

CRYSTAL:
BEI:-A natural or synthetic piezoelectric or semiconductor material whose atoms are with some degree of geometric regularity. [source-MCGRAW-HILL DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS, 386 (2d ed.1978)]
BEI:-A macroscopic sample of a solid substance exhibiting some degree of geometrical regularity, or symmetry, or capable of showing these properties after suitable treatment (e.g., cleavage, etching, etc.)

[source-VAN NOSTRAND'S SCIENTIFIC ENCYCLOPEDIA, 859 (8th ed.)]
Matsushita: A homogeneous solid formed by a repeating three-dimensional pattern of atoms, ions, or molecules having fixed distances between constituent parts.

CRYSTALLINE MATERIAL:
BEI: A material of, pertaining to, or composed of crystals. [source-MCGRAW-HILL DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS, (2d ed.1978)]
Matsushita:-Synonym for crystal.

CRYSTALLOGRAPHIC ORIENTATION:
BEI: The directions of the axes of a crystal lattice relative to the surfaces of the crystal, to applied fields, or to some other planes or directions of interest. [source-MCGRAW-HILL DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS, (2d ed. 1978)("Orientation [Crystal]").]
Matsushita: The direction of the electrical axis of a crystal.

B. Common Shaft Serving As An Output Shaft

This phrase is construed as follows:

This is the common shaft or handle of the tuning fork, from which the output signal may be derived.

This construction is consistent with the file history of the '663 patent. There is nothing in the file history to limit the output signal's origination to the common shaft.

C. Tuning Fork Providing A Balanced Resonant Sensor Responsive Solely To A Component Of Angular Motion About The Longitudinal Axis Of The Output Shaft

This phrase is not ambiguous and does not require construction. The fact that there may be environmental factors present such as temperature, shock or vibration, does not make the phrase ambiguous or affect its plain language.

D. Driving Means Coupled To Said Tines For Causing Them To Vibrate At A Drive Frequency

This is a means-plus-function limitation. The function called for by the limitation is the causing of the tines to vibrate at a particular frequency. The structure described in the specification which performs the function is a drive oscillator. It is displayed in Fig. 8 and Fig. 9 of the drawings and is described at col. 6, ll. 7 to 9 of the specification as follows:

... a tuning fork energized by a drive oscillator ...

and col. 5, ll. 40-41, as follows:

... the input lead 90, 91 from the drive oscillator are connected ...

E. Electrode Means ... Positioned On Said Tuning Fork For Sensing Said Piezoelectric Signals Representative Of The Angular Rate Of Motion

As stated above, the parties agree that this is not a means-plus-function limitation. The phrase is not ambiguous. For a better understanding, as to what the phrase calls for, the Court will instruct the jury as follows:

This limitation calls for one or more electrodes positioned on the tuning fork tines or shaft or both which sense the piezoelectric signals generated by strain caused by the torsional deflection of the fork resulting from angular rotation of the fork.

III.

The Court has fully considered Matsushita's arguments in opposition to BEI's proffered constructions and has, to the extent not reflected in this order, rejected them. However, nothing in this order precludes Matsushita in arguing against infringement to assert, once the infringing device is in issue and the Court made aware of the material from which it is constructed, that BEI's efforts to read claim 1 on the infringing device are limited under the doctrine of argument-based estoppel. *See* Elkay Mfg. Co. v. Ebco Mfg. Co., 192 F.3d 973, 979 (Fed.Cir.1999).

SO ORDERED.

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