PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 7,238,888

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the *Inter Partes* Review of U.S. Patent No. 7,238,888

Trial No.: Not Yet Assigned

Issued: July 3, 2007

Filed: October 13, 2004

Inventors: Yoshihide Goto, *et al.*

Assignee: Goto Denshi Co., Ltd.

Title: WIRE FOR COIL

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PETITION FOR *INTER PARTES* REVIEW UNDER 37 C.F.R. § 42.100

On behalf of Mitsubishi Cable Industries, Ltd. and Mitsubishi Cable America, Inc. ("Mitsubishi" or "Petitioner") and in accordance with 35 U.S.C. § 311 and 37 C.F.R. § 42.100, *inter partes* review is respectfully requested for claims 1-8 of U.S. Patent No. 7,238,888 ("the '888 patent"), attached hereto as Exhibit 1001.

The undersigned representative of Petitioner authorizes the Patent Office to charge the $23,000 Petition and Post-Institution Fees, along with any additional fees, to Deposit Account 501432, ref: 621525-615001. Eight claims are being reviewed, so the required Petition and Post-Institution Fees are $23,000.

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I. INTRODUCTION

The '888 patent claims a wire for use in a coil, *e.g.* speaker coil, in which the wire has a square cross-sectional shape with chamfers at the four corners. (Ex. 1001 claims 1-4.) But such a wire was well-known for more than a decade before the filing date of the '888 patent. In fact, the foreign patent application to which the '888 patent claims priority—with essentially identical claims—was rejected by the Japanese Patent Office ("JPO") because the prior art disclosed the specific mathematical dimensions for each of the claims.

The JPO relied on two publications to reject Japanese Application No. 2003/384209 to which the '888 patent claimed priority ("Japanese Priority Application"): (1) Japanese Pat. Publ. No. 2003-245711 ("Sugita") (Ex. 1002); and (2) Japanese Utility Model Publ. No. H01-176315 ("Nakagawa") (Ex. 1003). For the same reasons provided by the JPO, claims 1-8 of the '888 patent should be invalidated based on Sugita and Nakagawa. Of these two references, only Nakagawa was disclosed during prosecution of the '888 patent.

Nakagawa, however, was not relied on by the Examiner as a basis for rejecting the claims, and for good reason, because the patentee failed to disclose a full English translation of Nakagawa during prosecution. (*See* Ex. 1004.) Instead, the patentee only included a mere eight lines from the 7-page publication that failed to reveal key elements of the Nakagawa reference, including that it disclosed a "wire used for a wound coil, such as a voice coil" (Ex. 1003 at p. 1, lines 8-9), and the wire had "a cross

section in the shape of a square having corners of a radius with a certain curvature," (*Id.* at p. 1, lines 3-6).

Regardless, Petitioner here need not rely on the Nakagawa reference because an additional prior art reference, JP Pat. Publ. No. 2002-260461 ("Harada") (Ex. 1005), contains more information than Nakagawa, such that it anticipates all the claims. Thus, Petitioner includes Harada as a primary reference, applying the JPO's same calculations and reasoning as it did for Nakagawa.

Petitioner submits that had full English translations of these references been disclosed during prosecution, claims 1-8 of the '888 patent would not have issued, and therefore this petition for *inter partes* review should be granted.

II. GROUNDS FOR STANDING PURSUANT TO 37 C.F.R. § 42.104(A)

Petitioner certifies that the '888 patent is available for *inter partes* review and that Petitioner is not barred or estopped from requesting *inter partes* review challenging the patent claims on the grounds identified herein.

III. BACKGROUND INFORMATION FOR THE '888 PATENT

The '888 patent application was filed on October 13, 2004, and the patent issued on July 3, 2007. The '888 patent claims priority to the Japanese Priority Application, filed on November 13, 2003, which contains effectively identical claim language. (Ex. 1006 ¶ 47; *see* Ex. 1008 at p. 2.) The Japanese Priority Application underwent a rigorous review and appeal process before all of the claims were finally rejected by the JPO on November 4, 2008. (*See* Ex. 1008 at pp. 3, 11, 20 and 22.) The JPO rejected

all the claims based on Sugita and Nakagawa. (*Id.* at 4 and 12-20.) The '888 patent is assigned to Goto Denshi Co., Ltd. of Yamagata, Japan.

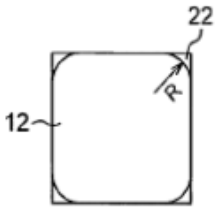
A. Overview of the '888 Patent

The '888 patent is directed to a wire having a square cross section with chamfers at the four corners ("the claimed wire"). (Ex. 1001 at 1:7-8, Abstract; *see* Fig. 2.) Claim 1 covers:

> 1. A wire for use in a coil, said wire having a square sectional shape, wherein chamfers are provided at four corners in the section of the square, and sectional area of said wire having the chamfers is at least 1.15 times as large as that of a circle having a diameter which is the same as the length of one side of said square.

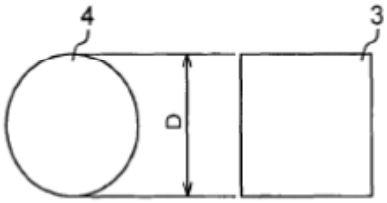
(*Id.* claim 1.) Pictorially, the claimed wire has a cross section as seen in Figure 2 with the four 90° corners removed, leaving just the rounded corners. (*Id.* Fig. 2; Ex. 1006 ¶ 44.) The '888 patent generally describes that a square wire is used as a base and that, in at least one embodiment, the claimed wire is prepared from the square wire by chamfering. (Ex. 1001 at 5:19-21; Ex. 1006 ¶ 44) The '888 patent does not, however, describe how the chamfering is performed. (Ex. 1006 ¶ 44) The claimed wire is designed for use in the windings of a coil, *e.g.*, a speaker coil or voice coil. (Ex. 1001 at 1:6-7, 5:3-7, 5:10-6:51.)

FIG. 2



The '888 patent includes two independent claims that cover the claimed wire. Each of these claims refers to a circle with a diameter equal to the length of one side of the claimed wire. (*Id.* claims 1, 3, Fig. 5.) This circle represents a hypothetical round wire ("reference wire" or "reference circle") to which the claimed wire is compared. The first independent claim and its dependent claims require that the claimed wire have a cross-sectional area that is at least 1.15 times as large as that of the reference wire 4. (*Id.* at 2:9-24, Abstract, claims 1, 2, 5 and 6; *see* Fig. 5.)

FIG. 5



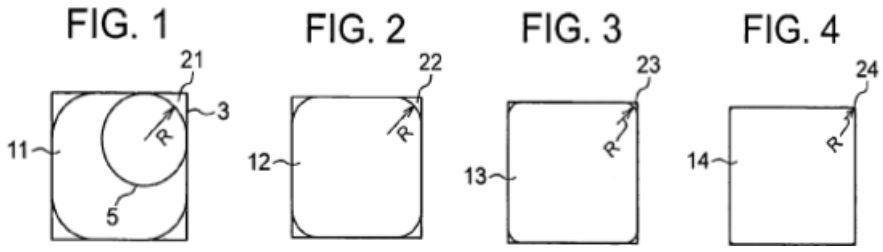
The second independent claim and its dependent claims require that the circumference of the cross section of the claimed wire be at least 1.09 times as long as the circumference of the reference wire. (*Id.* at 2:25, claims 3, 4, 7 and 8.) These two types of claimed wires may have either arc-shaped or linear chamfers. (*Id.* at 4:59-60.) Four of the dependent claims state that the chamfers must be arc-shaped. (*Id.* claims 2, 4, 6 and 8.) Four dependent claims state that the length of one side of the square

shaped claimed wire must be 1 mm or less. (*Id.* at 2:44-45, claims 5-8.)

The '888 patent teaches that the prior art in this field includes round wires and square wires, and that each type of wire has drawbacks when used in a coil. (*Id.* at 1:10-62.) Round wires leave gaps between the wires when wound in a coil, resulting in a low packing factor. (*Id.* at 1:14-17.) The square wire solves the low packing factor, but has issues with insulation, namely varying thickness of insulation at the four corners. (*Id.* at 1:28-55.) The '888 patent admits that square shaped wires with chamfers existed in the prior art, but states that the problem with square, chamfered wires is that if the chamfers are too large, rolling may occur during the winding of a coil, reducing the packing factor to less than that of a round wire. (*Id.* at 1:62-67.) Respondent further admitted during prosecution of the Japanese Priority Application that for "a coil wire, the concept of the cross-sectional square wire provided with a chamfered part on the four corners of the square cross-section is collective wisdom," and respondent "acknowledged the providing of an R part on the corners of the cross-sectional square wire as a commonly known fact." (Ex. 1009 at p. 2.) The '888 patent seeks to solve these drawbacks of the prior art by creating "a coil wire by which a higher-performance and higher-quality coil can be obtained at a price almost equal to that of a conventional round wire." (Ex. 1001 at 2:6-8.) The patent does this by claiming a square wire with chamfers at the four corners having a specific cross-sectional area or circumference (*i.e.* wires with a cross-sectional area greater than or equal to 1.15 times as large as the area of a reference circle, or wires with the length of the outer perimeter or circumference

greater than or equal to 1.09 times as long as the reference circle circumference). (*Id.* at 2:9-67; *see also* Figs. 1-4.) According to the '888 patent, the claimed wire removes the rolling problem associated with the winding process. (*Id.* at 2:54-55.)

To illustrate the claimed wire, the '888 patent describes four embodiments, referring to Figures 1 through 4 to show embodiments of the claimed wire with different chamfer sizes that meet the claimed ranges for cross-sectional area and outer circumference. (*Id.* at 3:30-31.) In these embodiments, the chamfers at each corner of the square-shaped wires have an arc constructed from a circle 5 with radius R. (*See id.* Fig. 1.) Each of the four embodiments has a progressively smaller arc-shaped chamfer with a smaller radius R. (*Id.* at 3:33-4:58, Figs. 1-4.)



In summary, the '888 patent applies basic geometry learned in high school to determine the area and outer perimeter of the cross section of a square-shaped wire with chamfers in reference to a round reference wire. (Ex. 1006 ¶ 32; *see* ¶¶ 31-41.)

The '888 patent includes two independent claims and six dependent claims. The two independent claims both claim a wire for use in a coil that has a square sectional shape with chamfers (arc-shaped or linear) on all four corners of a square. Independent

claim 1 requires that the cross-sectional area of a square wire with chamfers be at least 1.15 times as large as that of a reference circle, and independent claim 3 requires that the perimeter of the square sectional shape wire with chamfers be at least 1.09 times the circumference of the reference circle. (Ex. 1001 at 2:9-15, 2:25-33, 3:54-64, claims 1, 3.) Dependent claims 2 and 4 require the chamfers to be arc-shaped. (*Id.* claims 2, 4.) Dependent claims 5-8 depend from claims 1-4 respectively and set the length of a side of the wire to 1 mm or less. (*Id.* claims 5-8.)

B. Geometry of the '888 Patent

The claims of the '888 patent require the claimed square[1] sectional shaped wire to be greater than or equal to one of two established ratios. The first ratio compares the area of a cross-section of the claimed wire with the area of a reference circle. (Ex. 1001 claims 1, 2, 5, 6.) The second ratio compares the length of the outer perimeter of the claimed wire to the circumference of a reference circle. (Ex. 1001 claims 3, 4, 7, 8.) These ratios are based on simple geometry of squares, circles and squares with arc-shaped or linear corners. (Ex. 1006 ¶ 31; *see* Ex. 1010 at pp. 314-19.) Set forth below is a chart of relevant equations with the following variables: A = area; L = outer perimeter or circumference of wire; R = radius of claimed wire's corner

[1] A person having ordinary skill in the art at the time of the '888 patent application would understand "square wire" to encompass both a perfectly square wire with sharp corners and a square having rounded or chamfered corners. (Ex. 1006 ¶ 30.)

chamfer; D = length of a side of square and diameter of corresponding reference circle; and $r = (D/2)$ radius of reference circle with diameter D. (Ex. 1006 ¶ 41.)

Equation	Description
$A_{square} = D^2$	Area of a perfect square wire, where D is the length of one side of square
$A_{circle} = \pi r^2 = \pi(D/2)^2$	Area of reference circle
$A_{removed\ by\ chamfers} = 4R^2 - \pi R^2 = (4 - \pi)R^2$	Area of the perfect square that is removed by rounded chamfers having radius R.
$A_{claimed\ wire} = D^2\text{-}(4 - \pi)R^2$	Area of the claimed wire is the area of a perfect square minus the area removed at the four corners by the chamfers.
$L_{square} = 4D$	Perimeter of a perfect square wire
$L_{circle} = 2\pi r = \pi D$	Perimeter of the reference circle
$L_{claimed\ wire} = 4D - (8\text{-}2\pi)R$	Perimeter of the claimed wire with radiused corners is the lengths of the linear portions plus the lengths of the radiused corner portions.
Space Factor = $(D^2\text{-}(4\text{-}\pi)R^2) \ / \ D^2$	Space Factor is the ratio of the area of the claimed wire to the area of a perfect square.

(*Id.*)

IV. IDENTIFICATION OF CHALLENGE PER 37 C.F.R. § 42.104(B)

A. 37 C.F.R. § 42.104(b)(1): Requested Claims for *Inter Partes* Review

Inter partes review is requested for claims 1-8 of the '888 patent.

B. 37 C.F.R. § 42.104(b)(2): The Prior Art and Specific Grounds on Which the Challenge to the Claims Is Based

Inter Partes review is requested in view of the following prior art references:

- Japanese Pat. Publ. No. 2003-245711 ("Sugita") (Ex. 1002.) Sugita was filed on July 4, 2002, and published on September 2, 2003, and is prior art to the '888 patent under 35 U.S.C. §§ 102(a) and (b).
- Japanese Utility Model Publ. No. H01-176315 ("Nakagawa") (Ex. 1003.) Nakagawa was filed on June 1, 1988, and published on December 15, 1989, and is prior art to the '888 patent under 35 U.S.C. §§ 102(a) and (b).
- Japanese Pat. Publ. No. 2002-260461 ("Harada") (Ex. 1005.) Harada was filed on March 2, 2001, and published on September 13, 2002, and is prior art to the '888 patent under 35 U.S.C. §§ 102(a) and (b).
- T.J. Glover, Pocket Ref (Sequoia Publishing, 2001) (1989) ("Math Pocket Reference") (Ex. 1010.) Published in 2001, Math Pocket Reference is prior art to the '888 patent under 35 U.S.C. §§ 102(a) and (b).

- MWS Wire Industries Web Pages ("MWSWire")[2] (Ex. 1011-1012.)

  MWSWire, which was provided by and authenticated by the Internet Archive, was archived on October 13, 1999, and had the following names and URLs: For Ex. 1011 "Microsquare Magnet Wire," http://web.archive.org/web/19991013044251/http://www.mwswire.com/microsq.htm; and for Ex. 1012 "Copper Microsquare Information," http://web.archive.org/web/19991013054205/http:/www.mwswire.com/microsq1.htm. MWSWire is prior art to the '888 patent under 35 U.S.C. §§ 102(a) and (b).

The specific statutory grounds under 35 U.S.C. §§ 102 or 103 on which the challenge to the claims is based, and the patents and publications relied upon for each ground, are as follows:

1) Claims 1-8 are anticipated by Sugita under 35 U.S.C. §§ 102(a) and (b);

2) Claims 1-8 are anticipated by Harada under 35 U.S.C. §§ 102(a) and (b);

3) Claims 1-8 are obvious under 35 U.S.C. § 103(a) over Sugita and Math Pocket

[2] The webpage printouts of MWSWire (Exs. 1011-1012) have been authenticated by the Internet Archive that maintains the Wayback Machine; namely it has been authenticated that the date of archiving of MWSWire to the Wayback Machine would have occurred on October 13, 1999. (Affidavit of Christopher Butler dated April 3, 2015 with Exhibit A of MWSWire.) (Ex. 1013.)

Reference;

4) Claims 1-8 are obvious under 35 U.S.C. § 103(a) over Harada in view of Math Pocket Reference;

5) Claims 1-8 are obvious under 35 U.S.C. § 103(a) over Sugita in view of MWSWire;

6) Claims 1-8 are obvious under 35 U.S.C. § 103(a) over Harada in view of MWSWire; and

7) Claims 1-8 are obvious under 35 U.S.C. § 103(a) over Harada in view of Nakagawa.

C. 37 C.F.R. § 42.104(b)(3): Claim Construction

Claims are to be given their "broadest reasonable construction in light of the specification." 37 C.F.R. § 42.100(b). The constructions proposed below are intended to aid in this proceeding, and should not be understood as waiving any arguments concerning indefiniteness that may be raised in any litigation. Further, because the standard for claim construction at the Patent Office is different than that used during a U.S. District Court litigation, *see In re Am. Acad. of Sci. Tech Ctr.*, 367 F.3d 1359, 1364, 1369 (Fed. Cir. 2004); Manual of Patent Examining Procedure § 2111, Petitioner expressly reserves the right to argue a different claim construction in litigation for any term of the '888 patent as appropriate in that proceeding.

The earliest claimed priority date of the '888 patent is November 13, 2003. The '888 patent is directed to a square-shaped wire with chamfers at the corners that is used

in a coil. (*See* Ex. 1001 Abstract.) A person of ordinary skill in the art ("POSITA") would have a minimum of a two-year technical degree in the mechanical or electrical arts, and a POSITA would have a minimum of one to two years of professional experience in the mechanical, electrical, or other engineering field involving wire, coil, or cable construction. (Ex. 1006 ¶ 26.)

"***length of one side of said square***" – claims 1 through 8. The term "length of one side of said square" is neither defined in the '888 patent nor a "term of art" having a specific meaning within the field of wire construction. (Ex. 1006 ¶ 53.) Other than the claims, this term only appears in the Summary of Invention that repeats the same claim language. (*See* Ex. 1001 at 2:9-45.)

The '888 patent, however, provides an explanation and example of what is meant by the length of one side of the square, utilizing the square of Figure 5:

> For explanation, a length D of one side of a square 3 having a square sectional shape as the base of creation of the wire of the invention shown in FIG. 5 is set to 0.3 mm. . . . As shown in FIG. 1, in a coil wire of the invention (hereinbelow, called 'wire of the invention') serving as a conductive part of an electric wire for a coil an arc-shaped chamfer 21 is provided at each of the four corners in a cross section of a square wire having a square sectional shape and whose one side is D. . . . The length D of one side of the square 3 is 0.3 mm.

(*Id.* at 3:39-67; *see also id.* at 4:38-53.) This indicates that the length referred to is not a length along a corner chamfer, nor the length of the side of the square between the

corner chamfers, but rather the length of the side of a perfect square without any chamfers—which is also the distance between the two opposite sides of the square. (Ex. 1006 ¶ 54.) Thus, the term "length of one side of said square" includes "the length of the side of the smallest circumscribing square surrounding the square wire with chamfers." (*See* Ex. 1006 ¶¶ 52-55.)

"***chamfer***" – claims 1 through 8. The term "chamfer" is not defined in the '888 patent, but it is a term of art in engineering design meaning an edge break formed by a linear, angular facet, or a "beveled surface to eliminate an otherwise sharp corner." (*Id.* ¶ 57.) "Chamfer" does not have a more specific meaning within the field of wire construction. (*Id.*) Claims 1 and 3 state that "chamfers" are "provided at four corners in the section of the square." (Ex. 1001 claims 1, 3.) Claims 2 and 4 state "arc-shaped chamfers are provided at four corners in the section of the square . . . ." (*Id.* claims 2 and 4.) The '888 patent provides that a "shape in which chamfers (including arc-shaped chamfers ('R part') and linear chamfers) are not provided at all at the corners is preferable." (*Id.*, 1:35-39; *see also* 1:39-67, 2:49-53, Abstract.) "Although not shown, the chamfer can take the form of a linear chamfer." (*Id.* at 4:59-60.) Additionally, the '888 patent provides examples illustrating the presence of a chamfer at the four corners of an otherwise perfect square wire. (*Id.* at 3:3-18, 3:32-35, 3:45-48, 4:16-54, Figs. 1-4.) Thus, the term "chamfer" includes "any corner break, including linear or arc-shaped, on the corner of an otherwise square wire." (*See* Ex. 1006 ¶¶ 56-59.)

"***arc-shaped***" – claims 2, 4, 6 and 8. The term "arc-shaped" is neither defined

in the '888 patent nor a "term of art" having a specific meaning within the field of wire construction. (*Id.* ¶ 61.) Claims 2 and 4 recite that "the radius of an arc of said arc-shaped chamfer," hence they state that the "arc" of the "arc-shaped chamfer" has to have a radius. (Ex. 1001 claims 2, 4.) The '888 patent provides that "by setting the length of the radius R of the arc (the radius R of the circle 5) of the arc-shaped chamfer 21, the area of the sectional shape 11 of the coil wire can be set to a desired value." (*Id.* at 4:26-30.) Additionally, the '888 patent provides examples illustrating the formation of the arc-shaped chamfer at the four corners of an otherwise perfect square wire, and they illustrate that "arc-shaped" is a 90-degree arc of a circle having a radius R. (*Id.* at 3:45-48, 4:16-18, 4:38-40, 4:45-47, 4:52-53, Figs. 1-4.) Thus, "arc-shaped" includes at least "a curved shape such that the radius of curvature is the same at all points along the curve." (*See* Ex. 1006 ¶¶ 60-64.)

"***coil***" – claims 1 through 8. The term "coil," which is not defined in the '888 patent, has a very specific meaning in the field of wires: "an assemblage of successive convolutions of a conductor." (*See id.* ¶ 66.) The '888 patent provides that "[b]y covering a round wire as a conductor with an insulating layer, a round electric wire is formed. When a coil is manufactured by using such a round wire, naturally, a gap is created between round wires." (Ex. 1001 at 1:12-16.) Additionally, the '888 patent describes "a winding method for obtaining a coil shape." (*Id.* at 1:26-27; *see also id.* at 5:3-8.) Finally, the '888 patent provides two embodiments involving a speaker coil or voice coil. (*Id.* at 5:10-7:32.) Thus, the term "coil" includes at least "an assemblage of

successive convolutions of a conductor." (*See* Ex. 1006 ¶¶ 65-69.)

D. 37 C.F.R. § 42.104(b)(4): How the Construed Claims Are Unpatentable

An explanation of how claims 1-8 are unpatentable, including identification of how each claim element is found in the prior art, is set forth below in Section V. Sections V.A. – V.B. set forth anticipation grounds for claims 1-8, and Sections V.D. – V.H. set forth obviousness grounds for claims 1-8. The obviousness grounds detail why the claimed subject matter as a whole would have been obvious to a POSITA at the time of the alleged invention. These grounds take into account the scope and content of the prior art, the differences between the claimed subject matter and the art, and the level of ordinary skill in the art at the earliest priority date.

E. 37 C.F.R. § 42.104(b)(5): Supporting Evidence

An Appendix of Exhibits supporting this Petition is attached. Included at Ex. 1006 is a Declaration of Richard W. Klopp, Ph.D., P.E., under 37 C.F.R. § 1.68.

V. THERE IS A REASONABLE LIKELIHOOD THAT AT LEAST ONE CLAIM OF THE '888 PATENT IS UNPATENTABLE

A. Claims 1-8 Are Anticipated by Sugita (JP Publ. No. 2003-245711)

Sugita was not made of record or considered during the examination of U.S. Application Serial No. 10/964,345, which issued as the '888 patent. But Sugita was used by the JPO to reject the claims of the corresponding Japanese Priority Application. (Ex. 1008 at 4-8, 12-20.) This rejection in the Japanese Priority Application was appealed, and the rejection was affirmed. (*Id.* at 11-12, 20.)

Sugita relates generally to a die for drawing a deformed wire. (Ex. 1002, Abstract.) Specifically, the die is a diamond die for deforming a wire by drawing a wire rod through a die body made of sintered diamond with a square or rectangular cross section. (*Id.* Abstract, ¶ 0001.) The die body 1 has a sintered diamond 5, including the inclined section 6 consisting of a bell portion 6a, an approach portion 6b, a reduction portion 6c, a bearing portion 6d, a back relief portion 6e, and an exit portion 6f. (*Id.* ¶ 0012, Figs. 2 and 3.)

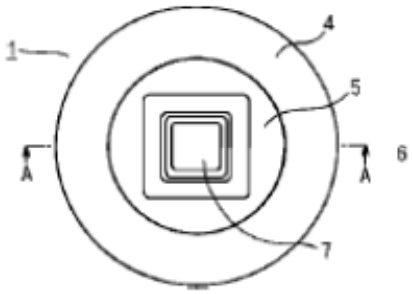


FIG. 2

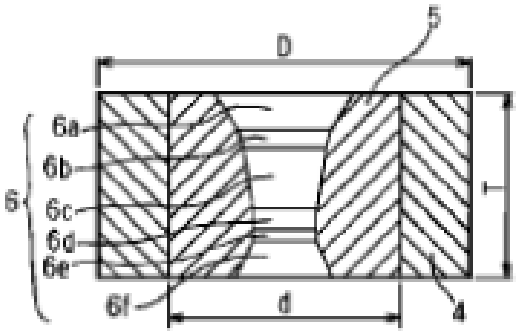


FIG. 3

A cross section of the bearing portion depicts a square shape with arc-shaped corners, and Sugita claims a "die for drawing a deformed wire as in claims 1 or 3 wherein the aforementioned deformed shape is a square shape or a rectangular shape." (*Id.* claim 4, ¶ 0008, Fig. 2.) Sugita discloses that "an R of each of corner sections of the deformed shape of the bearing section is 0.02 mm-0.6 mm inclusive." (*Id.* ¶ 0006; *see also id.* claims 1, 10 and 11.) In two embodiments, Sugita teaches that a wire drawn through its die would result in a copper wire where "the R of the corner sections was 30 μm . . . ." (*Id.* ¶¶ 0031, 0034.) While the corner sections of the die body are arc-

shaped, the "other sections are straight." (*Id.* ¶ 0006; *see also id.* claims 1, 10 and 11.) The distance between the opposite surfaces of the rectangle or square is preferably in the range of 0.1 mm to 0.6 mm. (*Id.* ¶ 0008, claim 5.)

1. Sugita Inherently Discloses the Ratios and Dimensions Claimed by the '888 Patent

Sugita inherently discloses the ratios and dimensions of the claimed wire of the '888 patent and expressly discloses the rest. "A single prior art reference that discloses, either expressly or inherently, each limitation of a claim invalidates that claim by anticipation." *Perricone v. Medicis Pharm. Corp.*, 432 F.3d 1368, 1375 (Fed. Cir. 2005). To demonstrate inherent disclosure, "evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." (*Cont'l Can Co. USA, Inc. v. Monsanto Co.*, 948 F.2d 1264, 1268 (Fed. Cir. 1991).) Ratios may be inherently found by mathematical or geometric disclosures. (*See, e.g.*, *Hycor Corp. v. Schlueter Co.,* 564 F. Supp. 996, 1001-02 (W.D. Wis. 1983) *aff'd in part, rev'd in part*, 740 F.2d 1529 (Fed. Cir. 1984) (finding a claimed ratio of diameter to thickness inherent based on sizes of wire screens from a catalog); *PBI Performance Products, Inc. v. NorFab Corp.*, 514 F. Supp. 2d 732, 737 (E.D. Pa. 2007) (finding claimed ratio in illustrations that do not expressly state the ratio).)

(a) Sugita Inherently Discloses the Ratios of Claims 1-8

Sugita inherently discloses the two ratios found in claims 1-8. A ratio does not need to be expressly stated in the prior art, but rather it can be inherently disclosed by the dimensions or illustrations disclosed in the prior art that demonstrate the claimed ratio. (*See, e.g.*, *Hycor Corp.,* 564 F. Supp. at 1001-02; *PBI Performance Products, Inc.*, 514 F. Supp. 2d at 737.)

Each claim of the '888 patent requires that one of the following ratios is met: (1) "sectional area of said wire having the chamfers is at least 1.15 times as large as that of a circle having a diameter which is the same as the length of one side of said square," ("area ratio") (Ex. 1001 claims 1, 2, 5 and 6), or (2) "overall length of an outer circumference of the section of said wire having said chamfers is at least 1.09 times as long as circumference of a circle having a diameter which is the same as the length of one side of said square," ("length ratio") (*Id.* claims 3, 4, 7 and 8).

Sugita discloses dimensions of a square wire with chamfers that necessarily meets the claimed area ratio (greater than or equal to 1.15) required in claims 1, 2, 5 and 6. (*See id.*) Specifically, Sugita sets forth two examples in which a wire is drawn through a die having a bearing section 6d with 0.35 mm on each side and corners with a radius R of 30 μm. (Ex. 1002 ¶¶ 0031 and 0034.) A square copper wire that starts with sides of 0.38 mm is drawn through this die in order to produce a wire ("resulting wire") with sides of 0.35 mm and chamfers of radius 30 μm (or .03 mm). (*Id.*; *see* Ex. 1006 ¶¶ 80-

81.) The resulting wire must necessarily have sides of 0.35 mm after being drawn through the square die with 0.35 mm sides. (Ex. 1006 ¶ 81.)

In the two Sugita examples, the area of the resulting wire with arc-shaped corners is calculated by the following equations:

$$A_{\text{resulting wire}} = D^2 - (4 - \pi)R^2 = (0.35\text{ mm})^2 - (4 - \pi)(.03\text{ mm})^2 = \underline{\mathbf{0.121727\ mm^2}}$$

(Ex. 1006 ¶ 82; *supra* Part III.B.) The area of a reference circle with diameter D that has the same length of a side of the square (0.35 mm) is as follows:

$$A_{\text{circle}} = \pi(.35\text{ mm}/2)^2 = \underline{\mathbf{0.0962113\ mm^2}}$$

(Ex. 1006 ¶ 83; *supra* Part III.B.) Accordingly, the sectional area of the resulting wire drawn through the die relative to the sectional area of a reference round wire having a diameter equal to the length of one side of the square wire is:

$$Area\ Ratio_{\text{resulting wire/reference wire}} = 0.121727\text{ mm}^2/0.0962113\text{ mm}^2 = \underline{\mathbf{1.265}}$$

Ex. 1006 ¶ 84; *supra* Part III.B.)

Claims 1, 2, 5 and 6 only require that the area ratio be "at least 1.15 times as large as that of a circle having a diameter which is the same as the length of one side of" the resulting wire. Sugita discloses a square wire with 0.35 mm sides and corners of radius 0.03 mm, which necessarily has an area ratio of 1.265, which is greater than 1.15. (*Id.* at ¶¶ 84-85.) Moreover, Sugita uses the same area ratio calculation as the '888 patent, because the maximum theoretical area ratio of a perfectly square wire relative to a circular wire in the '888 patent is 1.27, which corresponds to Sugita's disclosure that its square wire provides "the same power output as with round wire can be achieved with

27% less volume." (Ex. 1002 ¶ 0002; Ex. 1006 ¶ 88.) Accordingly, Sugita anticipates this claim element for all four claims. (Ex. 1006 ¶¶ 85-88, 94-96.)

The JPO relied on the same calculation in rejecting the Japanese counterpart claims. "[W]hen computation is performed based on this configuration, it can be said that Publication 1 [Sugita] describes: . . . a coil wire, where the sectional area of the wire having the chamfered sections is 1.265 times as large as the area of a circle having a diameter which is the same as the length of one side of the square, and the length of one side of the square is 0.35 mm . . . ." (Ex. 1008 at p. 7.)

Sugita also discloses dimensions of a square wire with chamfers that disclose the claimed length ratio (greater than or equal to 1.09) required in claims 3, 4, 7 and 8. Utilizing the same dimensions as used for the area ratio, namely 0.35 mm sides and arc-shaped corners with radius R of 30 μm (or .03 mm), the overall length of the outer perimeter of the square wire can be calculated. (Ex. 1006 ¶ 103.)

$$L_{\text{resulting wire}} = 4D - (8\text{-}2\pi)\underline{R} = 4(.35\text{ mm}) - (8\text{-}2\pi)(.03\text{ mm}) = \underline{\mathbf{1.3485\text{ mm}}}$$

(*Id.*) The circumference of a circle having a diameter (0.35 mm) which is the same as the length of one side of the resulting wire is as follows:

$$L_{\text{circle}} = \pi(.35\text{ mm}) = \underline{\mathbf{1.0996\text{ mm}}}$$

(*Id.* ¶ 104.) Accordingly, the ratio of the lengths of the resulting wire to the reference circle is calculated:

$$Length\ Ratio_{\text{resulting wire/reference wire}} = 1.3485\text{ mm}/1.0996\text{ mm} = \underline{\mathbf{1.226}}$$

(*Id.* ¶ 105.) There is no wire shape consistent with the Sugita disclosures that would have a length ratio less than 1.09. (*Id.* ¶ 106.)

Once again, the JPO relied on the same calculation when it rejected the Japanese counterpart claims. "[W]hen computation is performed based on this configuration, it can be said that Publication 1 [Sugita] describes: . . . a coil wire, where the overall length of the outer circumference of the wire having the chamfered sections is 1.226 as long as the perimeter of a circle having a diameter which is the same as the length of one side of the square, and the length of one side of the square is 0.35 mm . . . ." (Ex. 1008 at p. 7.)

Therefore, Sugita discloses claim 1's area ratio, i.e., the ratio of the cross section area of a square wire to the cross section area of a round wire, where the side length of the square equals the diameter of the circle. (Ex. 1006 ¶ 88.) Whereas Sugita does not have a similar disclosure regarding the length ratio, because the perimeters and areas of squares and circles are necessarily in mathematically fixed relationship, one ratio discloses the other. (*Id.*) Hence the length ratio is merely an interchangeable, obvious and known alternative to expressing the area ratio of the square wire and the round wire. (*Id.*) In fact, the maximum theoretical perimeter ratio, which is the ratio of the perimeter of the square to that of the circle, is also $4/\pi \approx 1.27$. (*Id.*)

The calculations for area ratio and length ratio are straightforward; the ratios are necessarily present in Sugita based on the dimensions disclosed, and a POSITA would

recognize that the ratios would be necessarily present. (*In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999); *see* Ex. 1006 ¶¶ 78-88, 101-07.)

(b) Sugita Discloses the Radius of Claims 2, 4, 6 and 8

Sugita refers to "R of the corner section." (*See, e.g.*, Ex. 1002 ¶¶ 0031, 0034.) Sugita discloses the "R" of the corner sections is the radius of the corner sections. (Ex. 1006 ¶¶ 86, 95.) Sugita uses "R" to define the arc-shaped corners to the square wire. (*Id.* ¶ 95.) A POSITA would understand that R must refer to a radius of that corner, because: (1) Sugita uses electrical discharge machining that naturally produces radiused corners; (2) Sugita assigns a single value to R; and (3) the JPO treated R as radius.[3] (*Id.* ¶¶ 86, 95, 206.) Based on the disclosure of Sugita, there is no other meaning for R other than the radius of the corners of the formed square shaped wire. (*See id.* ¶ 95.) The '888 patent likewise refers to the arc-shaped (radiused) chamfers as "R part." (Ex. 1001 at 1:36-37.) Therefore, Sugita discloses the radius of the corners of its square wire using "R."

(c) Sugita Discloses Claims 5-8

Sugita discloses that the length of the side of the wire is 1 mm or less, based on, for example, one embodiment of the Sugita in which a die has a bearing portion with square dimensions of 0.35 mm on each side. (Ex. 1002 ¶¶ 0031, 0034.) It is well-

[3] As demonstrated by calculations in the Japanese Priority Application's appeal, the JPO treated Sugita's "R" as radius. (*See* Ex. 1008 at pp. 7, 17.)

known by a POSITA that a die having a bearing portion with sides of 0.35 mm would create a wire with lengths of each side of 0.35 mm. (Ex. 1006 ¶¶ 79-81.) Here, claims 5-8 of the '888 patent require that the side of the claimed square wire is 1 mm or less. Sugita discloses a die having a bearing portion with sides of 0.35 mm through which a square wire with sides larger than 0.35 mm is drawn. (Ex. 1002 ¶¶ 0031, 0034; Ex. 1006 ¶¶ 79-81.) Specifically, Sugita discloses that before the square wire is drawn through the die, it had sides of 0.38 mm to ensure that the final resulting wire has a corner radius of 0.03 mm after it is drawn through the die. (Ex. 1002 ¶¶ 0031, 0034; Ex. 1006 ¶¶ 79-80.) The resulting wire would necessarily be a square with 0.35 mm on each side after being drawn through the die. (Ex. 1006 ¶ 81; Ex. 1008 at p. 7.) Since the disclosed wire has sides of 0.38 mm, the resulting wire must have sides of less than 1 mm, and therefore, Sugita discloses the length limitation in claims 5-8 of the '888 patent.[4]

[4] The JPO recognized this as well. "The numerical values in these wires and the methods are included within the value range of the invention according to claim 1-10 of the present application." (Ex. 1008 at p. 7.) Claims 1-4 in the Japanese Priority Application correspond to claims 1-4 in the '888 patent. (*See id.* at p. 2.) Claim 5 in the Japanese Priority Application, which further restricted claims 1-4 by adding the limiting that the "length of one side of said square is 1 mm or less," corresponds to claims 5-8 of the '888 patent. (*See id.*)

2. Sugita Discloses the Remaining Elements

(a) Claims 1 and 2

The first element of claim 1 of the '888 patent recites "[a] wire for use in a coil, said wire having a square sectional shape." Sugita discloses the fabrication of wire, and in particular, a wire with a "square shape cross section." (Ex. 1002 ¶ 0001; *see also* ¶ 0008, claims 4 and 5, Figs. 2 and 4.) Sugita discloses that its design is important to prevent twists in wires with a square shape, because it may "cause[] an irregular turn when the wire is wound to form, for example, a coil." (*Id.* ¶ 0016; *see also* ¶ 0002 (disclosing "voice coils used in speakers").)

The second element of claim 1 recites a square shaped wire "wherein chamfers are provided at four corners in the section of the square." Sugita discloses a die with radius R at each corner of bearing portion 6d, which may be 0.02 mm to 0.6 mm. (Ex. 1002 ¶¶ 0006, 0010, 0011, 0031 and 0034, Abstract, Figs. 2 and 4, claims 1, 10 and 11; Ex. 1006 ¶¶ 76-77.) Sugita provides two examples in which a die manufactures a square shaped wire with arc-shaped corners: "A die was obtained in the aforementioned manner, wherein the die has a hole with a size at the bearing section 6d of 0.35 mm on a side, and an R of the corner sections of the hole of 30 μm. . . . By using this diamond die, a wiredrawing process was performed on a copper wire having 0.38 mm on a side, so that the R of the corner was 30 μm, and the surface of the wire had an excellent shine." (Ex. 1002 ¶¶ 0031, 0034; Ex. 1006 ¶ 79.) Since sintered diamond does not give

way to copper wire, the resulting wire is square with sides of 0.35 mm and round corners of radius 30 μm. (Ex. 1006 ¶ 80.)

The third element of claim 1 recites a "sectional area of said wire having the chamfers is at least 1.15 times as large as that of a circle having a diameter which is the same as the length of one side of said square." This element is inherently if not expressly disclosed, as previously explained *supra* Section IV.A.1(a). Therefore, Sugita anticipates claim 1 under 35 U.S.C. §§ 102(a) and (b).

For claim 2 of the '888 patent, which depends from claim 1, the only additional limitations are that the chamfers of the square wire be arc-shaped and that the ratio of the "sectional area of the wire with *arc-shaped* chamfers be at least 1.15 times as large as that of a circle having a diameter which is the same as the length of one side of" the square wire. (Ex. 1001 claim 2 (emphasis added).) Sugita discloses chamfers with a radius, for example, stating that "the R of the corner was 30 μm." (Ex. 1002 ¶¶ 0031, 0034; *see* Ex. 1006 ¶¶ 81, 86, 92-93, 95.) Since the corners have a radius, they must be arc-shaped. (Ex. 1006 ¶ 95.) As in claim 1, the sectional area of claim 2 is inherently if not expressly disclosed in Sugita because its dimensions provide for a sectional area of 1.265 times greater than the area of a reference wire, which meets the claimed limitation of a sectional area "at least 1.15 times." (*Id.* ¶¶ 0031, 0034; Ex. 1006 ¶¶ 82-88.) Therefore, Sugita anticipates claim 2 under 35 U.S.C. §§ 102(a) and (b).

(b) Claims 3 and 4

Independent claim 3 of the '888 patent differs from claim 1 in only one respect. Instead of the "area ratio" limitation, claim 3 requires that the "overall length of an outer circumference of the section of said wire having said chamfers is at least 1.09 times as long as circumference of a circle having a diameter which is the same as the length of one side of said square." Sugita inherently discloses this ratio by disclosing a square wire with 0.35 mm sides and corners having a radius of 0.03 mm, which necessarily results in a length ratio of 1.226 that is always greater than 1.09. (Ex. 1006 ¶¶ 101-106; *supra* Section IV.A.1(a).) The JPO also rejected the corresponding claim in the Japanese Priority Application based on Sugita. (Ex. 1008 at pp. 4, 11, 20, 22 (rejecting all the claims of the Japanese Priority Application, of which claim 3 corresponds to claim 3 in the '888 patent).) Therefore, Sugita anticipates claim 3 under 35 U.S.C. §§ 102(a) and (b).

Claim 4 of the '888 patent, which depends from claim 3, adds the limitations that the chamfers of the square wire be arc-shaped and that the ratio of the overall length around the square with arc-shaped chamfers be "at least 1.09 times as long as circumference of a circle having a diameter which is the same as the length of one side of" the resulting wire. As with claim 2, Sugita discloses arc-shaped chamfers. (Ex. 1002 ¶¶ 0031, 0034; Ex. 1006 ¶¶ 86, 92-93, 95, 111.) And as calculated for claim 3, the resulting wire has an overall length around the perimeter of the wire of 1.226 times longer than the circumference of the reference wire, which exceeds the claimed 1.09

ratio. (Ex. 1002 ¶¶ 0031, 0034; *supra* Section IV.A.1(a); Ex. 1006 ¶¶ 101-107, 112-114.) Therefore, claim 4 is anticipated by Sugita under 35 U.S.C. §§ 102(a) and (b).

The claim chart below and the referenced Declaration of Dr. Richard W. Klopp demonstrate in detail how Sugita anticipates claims 1-8 of the '888 patent.

Claims of the '888 Patent	**Sugita**
1. A wire for use in a coil, said wire having a square sectional shape,	Sugita discloses this claim element. (*See* Ex. 1006 ¶¶ 73-75.) ¶ 0001: "The present invention relates to a wire deforming die for drawing wire that has a quadrangular, in particular, a rectangular or square shape cross section." *See also* ¶ 0008, claims 4 and 5. ¶ 0002: "Conventionally, winding wire has been used for electric motors in home appliances, vehicles, etc. Moreover, the demand has heightened for reducing the size of motors used in micro-machines and voice coils used in speakers, etc. When a wire having a square cross section is formed into winding wire, high space efficiency is obtained, and the same power output as with round wire can be achieved with 27% less volume. Thus, by using square winding wire, the size, weight, and costs of mobile phones, speaker units for vehicle use, electronic devices, motors, etc. can be significantly reduced." ¶ 0016: "With the present invention, it is most important to eliminate twists in a drawn wire. Even if twists form in a die used for forming wire having a circular cross section, the twists do not cause significant problems. In contrast, in the case of a deformed wire, and in particular, a wire with a rectangular or square shaped cross section, a twisted section causes an irregular turn when the wire is wound to form, for example, a coil. Preventing a deformed wire from twisting is an important issue for this reason as well." *See also* Figs. 2 and 4.
wherein chamfers are provided at four	Sugita discloses this claim element. (*See* Ex. 1006 ¶¶ 76-77.)

corners in the section of the square, and	¶ 0005: "The present invention seeks to provide a die for fabricating a deformed wire with few twists, wherein the R of the corner sections is 0.02 m to 0.6 mm inclusive, and in particular, the R of the corner sections is 0.02 mm to 0.06 mm inclusive and one side is 0.6 mm or less, and such a wire." *See also* ¶¶ 0006, 0010, 0011, 0031 and 0034. ABSTRACT: "The die has a die body made of sintered diamond, wherein the shape of the front face of the bearing section is deformed, the R of the corner sections is 0.02 mm-0.6 mm inclusive and the other sections are straight." *See also* Figs. 2 and 4, claims 1, 10 and 11.
sectional area of said wire having the chamfers is at least 1.15 times as large as that of a circle having a diameter which is the same as the length of one side of said square.	Sugita discloses this claim element. (*See* Ex. 1006 ¶¶ 78-88.) ¶ 0031: "A die was obtained in the aforementioned manner, wherein the die has a hole with a size at the bearing section 6d of 0.35 mm on a side, and an R of the corner sections of the hole of 30μm. The maximum diameter h of the hole is 0.49 mm, and the ratio of the maximum diameter to the outer diameter d of the sintered diamond 5 (h/d × 100) is 9.4%. By using this diamond die, a wiredrawing process was performed on a copper wire having 0.38 mm on a side, so that the R of the corner was 30μm, and the surface of the wire had an excellent shine." *See also* ¶ 0034.
2. A coil wire according to claim 1, wherein arc-shaped chamfers are provided at four corners in the section of the square, and	Sugita discloses this claim element. (*See* Ex. 1006 ¶¶ 91-93.) ¶ 0005: "The present invention seeks to provide a die for fabricating a deformed wire with few twists, wherein the R of the corner sections is 0.02 m to 0.6 mm inclusive, and in particular, the R of the corner sections is 0.02 mm to 0.06 mm inclusive and one side is 0.6 mm or less, and such a wire." *See also* ¶¶ 0006, 0010, 0011, 0031 and 0034. ABSTRACT: "The die has a die body made of sintered diamond, wherein the shape of the front face of the bearing section is deformed, the R of the corner sections is 0.02 mm-0.6 mm inclusive and the other sections are straight." *See also* Figs. 2 and 4, claims 1, 10 and 11.

length of the radius of an arc of said arc-shaped chamfer is set so that the sectional area of said wire having said chamfers is at least 1.15 times as large as that of a circle having a diameter which is the same as the length of one side of said square.	Sugita discloses this claim element. (*See* Ex. 1006 ¶¶ 94-96.) ¶ 0031: "A die was obtained in the aforementioned manner, wherein the die has a hole with a size at the bearing section 6d of 0.35 mm on a side, and an R of the corner sections of the hole of 30μm. The maximum diameter h of the hole is 0.49 mm, and the ratio of the maximum diameter to the outer diameter d of the sintered diamond 5 (h/d × 100) is 9.4%. By using this diamond die, a wiredrawing process was performed on a copper wire having 0.38 mm on a side, so that the R of the corner was 30μm, and the surface of the wire had an excellent shine." *See also* ¶ 0034.
3. A wire for use in a coil, said wire having a square sectional shape,	Sugita discloses this claim element. (*See* Ex. 1006 ¶¶ 99-100.) ¶ 0001: "The present invention relates to a wire deforming die for drawing wire that has a quadrangular, in particular, a rectangular or square shape cross section." *See also* ¶ 0008, claims 4 and 5. ¶ 0002: "Conventionally, winding wire has been used for electric motors in home appliances, vehicles, etc. Moreover, the demand has heightened for reducing the size of motors used in micro-machines and voice coils used in speakers, etc. When a wire having a square cross section is formed into winding wire, high space efficiency is obtained, and the same power output as with round wire can be achieved with 27% less volume. Thus, by using square winding wire, the size, weight, and costs of mobile phones, speaker units for vehicle use, electronic devices, motors, etc. can be significantly reduced." ¶ 0016: "With the present invention, it is most important to eliminate twists in a drawn wire. Even if twists form in a die used for forming wire having a circular cross section, the twists do not cause significant problems. In contrast, in the case of a deformed wire, and in particular, a wire with a rectangular or square shaped cross section, a twisted section causes an irregular turn when the wire is wound to form, for example, a coil. Preventing a deformed wire from twisting is an important

	issue for this reason as well." *See also* Figs. 2 and 4.
wherein chamfers are provided at four corners in the section of the square, and	Sugita discloses this claim element. (*See* Ex. 1006 ¶¶ 99-100.) ¶ 0005: "The present invention seeks to provide a die for fabricating a deformed wire with few twists, wherein the R of the corner sections is 0.02 m to 0.6 mm inclusive, and in particular, the R of the corner sections is 0.02 mm to 0.06 mm inclusive and one side is 0.6 mm or less, and such a wire." *See also* ¶¶ 0006, 0010, 0011, 0031 and 0034. ABSTRACT: "The die has a die body made of sintered diamond, wherein the shape of the front face of the bearing section is deformed, the R of the corner sections is 0.02 mm-0.6 mm inclusive and the other sections are straight." *See also* Figs. 2 and 4, claims 1, 10 and 11.
overall length of an outer circumference of the section of said wire having said chamfers is at least 1.09 times as long as circumference of a circle having a diameter which is the same as the length of one side of said square.	Sugita discloses this claim element. (*See* Ex. 1006 ¶¶ 101-107.) ¶ 0031: "A die was obtained in the aforementioned manner, wherein the die has a hole with a size at the bearing section 6d of 0.35 mm on a side, and an R of the corner sections of the hole of 30μm. The maximum diameter h of the hole is 0.49 mm, and the ratio of the maximum diameter to the outer diameter d of the sintered diamond 5 (h/d × 100) is 9.4%. By using this diamond die, a wiredrawing process was performed on a copper wire having 0.38 mm on a side, so that the R of the corner was 30μm, and the surface of the wire had an excellent shine." *See also* ¶ 0034.
4. A coil wire according to claim 3, wherein arc-shaped chamfers are provided at four corners in the section of the square, and	Sugita discloses this claim element. (*See* Ex. 1006 ¶¶ 110-111.) ¶ 0005: "The present invention seeks to provide a die for fabricating a deformed wire with few twists, wherein the R of the corner sections is 0.02 m to 0.6 mm inclusive, and in particular, the R of the corner sections is 0.02 mm to 0.06 mm inclusive and one side is 0.6 mm or less, and such a wire." *See also* ¶¶ 0006, 0010, 0011, 0031 and 0034.

	ABSTRACT: "The die has a die body made of sintered diamond, wherein the shape of the front face of the bearing section is deformed, the R of the corner sections is 0.02 mm-0.6 mm inclusive and the other sections are straight." *See also* Figs. 2 and 4, claims 1, 10 and 11.
length of the radius of an arc of said arc-shaped chamfer is set so that overall length of an outer circumference of the section of said wire having said chamfers is at least 1.09 times as long as circumference of a circle having a diameter which is the same as the length of one side of said square.	Sugita discloses this claim element. (*See* Ex. 1006 ¶¶ 112-114.) ¶ 0031: "A die was obtained in the aforementioned manner, wherein the die has a hole with a size at the bearing section 6d of 0.35 mm on a side, and an R of the corner sections of the hole of 30μm. The maximum diameter h of the hole is 0.49 mm, and the ratio of the maximum diameter to the outer diameter d of the sintered diamond 5 (h/d × 100) is 9.4%. By using this diamond die, a wiredrawing process was performed on a copper wire having 0.38 mm on a side, so that the R of the corner was 30μm, and the surface of the wire had an excellent shine." *See also* ¶ 0034.
5. A coil wire according to claims 1, wherein length of one side of said square is 1 mm or less.	Sugita discloses this claim element. (*See* Ex. 1006 ¶¶ 116-19.) ¶ 0003: "Thus, production of winding wire using conventional deforming die has been limited to production of large-size winding wire with cross sections of 0.6 mm or more on a side." ¶ 0008: "The aforementioned deformed shape is either a square shape or rectangle shape. More specifically, the distance between surfaces of the rectangle or square shape and opposing surface is preferably 0.1 mm-0.6 mm inclusive." *See also* ¶ 0006. ¶ 0031: "A die was obtained in the aforementioned manner, wherein the die has a hole with a size at the bearing section 6d of 0.35 mm on a side, and an R of the corner sections of the hole of 30μm." *See also* ¶¶ 0031 and 0034. Claim 5: "The diamond die for drawing a deformed wire as in claim 4 wherein a distance between opposing surfaces of

	aforementioned square shape and rectangular shape is 0.1 mm-0.6 mm inclusive." *See also* claims 6, 7.
6. A coil wire according to claims 2, wherein length of one side of said square is 1 mm or less.	Same disclosures for claim 5.
7. A coil wire according to claims 3, wherein length of one side of said square is 1 mm or less.	Same disclosures for claim 5.
8. A coil wire according to claims 4, wherein length of one side of said square is 1 mm or less.	Same disclosures for claim 5.

B. Claims 1-8 Are Anticipated by Harada (JP Appl. 2002-260461)

Harada was published by the JPO on September 13, 2002, (Ex. 1005), and it was not made of record or considered during the prosecution of the '888 patent.

Harada describes a wire used in a coil, as well as a method of manufacture for such a wire. (Ex. 1005 ¶ 0001; *see also* claims 1-5.) Harada discloses a wire that has a square sectional shape: "[the wire] has a vertical and horizontal cross-sectional dimensional ratio of between 1:1 and 1:2." (*Id.* claims 1, 2 and 4, ¶ 0005, Abstract, Fig. 1.) One embodiment of the coil wire comprises starting with "a round copper wire with a bare wire diameter of 0.32 mm, to produce a 0.26 mm x 0.26 mm essentially square wire." (*Id.* ¶ 0014.) Harada discloses a square wire with "R parts of the corner

portions." (*Id.* ¶¶ 0005, 0008, 0009; *see also* 0014, 0016.) Fig. 1 depicts the coil wire's cross section with square shape 1 and arc-shaped corners 2. (*Id.* Fig. 1.)

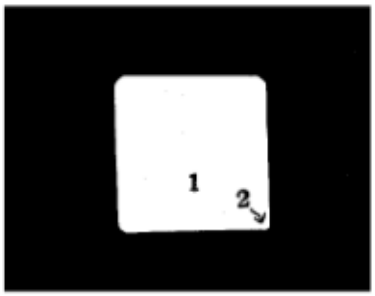


FIG. 1

Harada discusses many of the benefits of a square wire. Harada provides a method for manufacturing a square wire to "achieve an improvement in space factor and in insulating performance . . . ." (*Id.* Abstract, ¶ 0004.) Harada discloses that due to a need in coil wires for reduced sizes, improved space factors, and insulating performance, the cross-sectional shapes of the conductors have been changed from "round shapes (round conductors) to flat angular shapes (flat angular conductors)." (*Id.* ¶ 0002.) Harada also teaches that the arc-shaped corner portions of a square wire should be small, because it "is beneficial in improving the space factor."[5] (*Id.* ¶ 0005.)

[5] The space factor as used by Harada is the ratio or percentage of cross-sectional area that the wire occupies as compared to the cross-sectional area of a perfect square having the same side length D, *i.e.*, the smallest circumscribing square. (Ex. 1006 ¶ 39.) There is a direct correlation between the space factor and the claimed ratios: the higher the space factor, the higher the area ratio and the length ratio. (*Id.*)

1. Harada Inherently Discloses the Ratios of Claims 1 Through 8 of the '888 Patent

Harada inherently discloses the area ratio and length ratio found in claims 1-8, because it discloses a space factor that mathematically meets both claimed ratios in the '888 patent. (*See Hycor Corp.,* 564 F. Supp. at 1001-02; *PBI Performance Products, Inc.*, 514 F. Supp. 2d at 737.)

First, Harada discloses a square wire with arc-shaped corners with the space factor of either 96% or 99%. (Ex. 1005 ¶¶ 0002, 0014.) A wire with either space factor will necessarily have an area ratio of greater than or equal to 1.15 times as large as that of a circle having a diameter which is the same as the length of one side of said square. (Ex. 1006 ¶ 129-38, 151-60.) Harada explains that the prior art had changed the cross-sectional shapes of wires used in coils from round shapes to flat angular shapes to improve the space factors "from, for example, 91% to 96%." (Ex. 1005 ¶ 0002.) Harada describes a wire that has an even higher space factor (about 99%), stating: "the R parts at the corner portions (2) were smaller in the square copper wires (1) obtained through the first through fourth embodiments, which is beneficial to improving the space factor (improving to about 99%)." (*Id.* ¶ 0014.) A space factor of 99% means that a wire's cross-sectional area is 99% that of the area of a perfect square circumscribing the wire ($A_{\text{Harada wire}} = A_{\text{square}}*99\% = D^2*(0.99)$). (Ex. 1006 ¶ 134.) The area of the reference circle is $A_{\text{circle}} = \pi(D/2)^2$. (*Id.*) Therefore, the relative area of the wire's cross section to a reference circle is:

$$A_{\text{Harada wire}} / A_{\text{circle}} = D^2*(0.99)/\pi(D/2)^2 = (0.99*4)/\pi = \underline{\mathbf{1.26}}.^{6}$$

(*Id.* ¶ 135.) Thus, no matter what set of dimensions are selected, the cross section always will be 1.26 times larger than the reference circle's area. (*Id.* ¶ 136) Even if the calculation of this ratio is done using the 96% space factor of a square wire from the prior art disclosed in Harada, the ratio is at 1.22, which is still greater than the claimed 1.15 ratio of claims 1, 2, 5, and 6 of the '888 patent. (*Id.* ¶ 137.)

Similarly, a wire with arc-shaped corners with the space factor of 96% or 99%, will necessarily have a cross section with an outer circumference that is at least 1.09 times as long as the circumference of a circle having a diameter which is the same as the length of one side of the square. The equations for a space factor, $L_{\text{claimed wire}}$ and L_{circle} are known and mathematically defined. (*Supra* Section III.B; Ex. 1006 ¶¶ 38, 38, 41.) Harada discloses a space factor for an embodiment of its invention of about 99%, while in the prior art a space factor existed as high as 96%. (Ex. 1005 ¶¶ 0002, 0014.) Mathematically, a space factor of 87.93% corresponds to a length ratio of 1.09.

[6] The same calculation and method was used by the JPO on the Nakagawa reference (Ex. 1008 at p. 19.) to reject the corresponding, and nearly identical, claims in the Japanese Priority Application to the '888 Patent. (*Id.* at pp. 19-20.) The only difference was that the JPO performed its calculation using the 98% space factor disclosed in Nakagawa instead of the 99% disclosed in Harada.

(Ex. 1006 ¶ 157.) Therefore, any larger space factor necessarily results in a length ratio larger than 1.09. (*Id.*)

Along the same lines, the wire described by Harada will meet the length ratio limitation regardless of the dimensions *D* and *R*. The radius *R* of the arc-shaped corners disclosed in Harada is mathematically defined by a 99% space factor:

$$\textit{Space Factor} = 0.99 = (D^2 - (4 - \pi)R^2) / D^2$$

$$0.99D^2 = D^2 - (4 - \pi)R^2$$

$$(4 - \pi)R^2 = 0.01D^2$$

$$\underline{\boldsymbol{R = 0.1079D}}$$

(*Id.* ¶ 158.) Likewise, the ratio of the claimed wire length to the circumference of the reference circle is mathematically defined:

$$\textit{Length Ratio}_{\text{claimed wire/reference wire}} = L_{\text{claimed wire}} / L_{\text{circle}}$$

$$= (4D - (8\text{-}2\pi)R) / \pi(D)$$

(*Id.* ¶ 159.) Substituting, $R = 0.1079D$, results in a fixed ratio of 1.21:

$$\textit{Length Ratio}_{\text{claimed wire/reference wire}} = (4D - (8\text{-}2\pi)(0.1079D) / \pi(D)$$

$$= (4 - (8\text{-}2\pi)(0.1079)) / \pi$$

$$= \underline{\mathbf{1.21}}$$

(*Id.*) Because *D* and *R* have a fixed relationship based on the space factor, those variables cancel out in the length ratio so that no matter what dimensions for *D* and *R* are selected, Harada's disclosure of a square wire with arc-shaped corners of radius *R* with a space factor of 99% must have a length ratio of 1.21. (*See id.* ¶ 160.) Even if

the space factor were 96% as disclosed in the prior art, the length ratio would still be 1.16. (*Id.* ¶ 161.) These length ratios (1.16 and 1.21) reflect the shortest possible perimeters for Harada's wire with space factors of 96% and 99%, respectively. (*Id.* ¶ 163.) Thus, both space factors necessarily result in a wire that meet the claim limitation of a "length of an outer circumference of the section of said wire having said chamfers is at least 1.09 times as long as circumference of a circle having a diameter which is the same as the length of one side of said square."[7] (Ex. 1001 claims 3, 4, 7 and 8; Ex. 1006 ¶¶160-61.)

2. Harada Discloses the Remaining Elements

(a) Claims 1 and 2

The first and second elements of claim 1 of the '888 patent require a "wire for use in a coil" that has a "square sectional shape" with chamfers at the four corners. The Harada disclosure includes all of these elements. First, Harada discloses an

[7] The JPO rejected essentially identical claims using Nakagawa which describes a coil wire having a space factor of "about 98%, a square cross section, and chamfers at corner sections of the square cross section, and a method for fabricating the wire." (Ex. 1008 at pp. 7-8.) The JPO stated that "[i]t is obvious that numerical values obtained by performing computation based on this configuration are included in the value range of the invention according to claims 1-4 [utility claims] and 6-9 [method claims] . . . ." (*Id.* at p. 8.)

"insulated wire for coil winding." (Ex. 1005 ¶¶ 0001, 0002; *see also* ¶¶ 0005, 0008, 0009, 0016.) Second, Harada discloses a square sectional shape of wire based on Figure 1 that "has a vertical and horizontal cross-sectional dimensional ratio of between 1:1 and 1:2." (*Id.* claims 1 and 2, Abstract, ¶ 0005, Fig. 1.) Third, Harada discloses that it takes "a round copper wire with a bare wire diameter of 0.32 mm, to produce a 0.26 mm x 0.26 mm essentially square wire." (*Id.* ¶ 0014.) Fourth, Harada states that the square wire has "R parts of the corner portions." (*Id.* ¶¶ 0005, 0008, 0009; *see also* ¶¶ 0003, 0014, 0016.) "R parts of the corner portions" means the corners are arc-shaped with a radius R, because: (1) the Harada disclosure supports this meaning; (2) a POSITA would know R represents radius; and (3) "R parts" denotes "radius" in Japanese-to-English translations of prior art patents, including Sugita, the '888 patent and others. (Ex. 1006 ¶ 143-46.)

The third element of claim 1 requires that the area of the wire's cross section be 1.15 times that of a reference circle. Because Harada discloses space factors that necessarily result in a wire with a cross-sectional area that is 1.22 or 1.26 times the area of a reference circle, Harada inherently discloses a wire with a cross-sectional area that is greater than 1.15 times the area of a reference circle. (*Supra* Section IV.B.1.) Harada anticipates claim 1 under 35 U.S.C. §§ 102(a) and (b).

Claim 2 of the '888 patent, which depends from claim 1, includes the additional limitations that the chamfers of the square wire be arc-shaped wherein the "length of the radius of an arc of said arc-shaped chamfer is set so that the sectional area of said

wire having said chamfers is at least 1.15 times as large as that of a circle having a diameter which is the same as the length of one side of" the square wire. (Ex. 1001 claim 2.) Harada discloses that the chamfers of its square wire are arc-shaped "R parts." (Ex. 1005 ¶¶ 0003, 0005, 0008, 0009, 0014, 0016, Fig. 1.) Harada also discloses that during the manufacturing process, "corner portions assumed an R shape." (*Id.* ¶ 0014.) Those corner portions will be small. (*Id.* ¶¶ 0005, 0009, 0014, 0016.) Just as is used in the '888 patent, the Sugita reference and other Japanese to English translated patents from prior to the alleged time of invention, "R part" stands for radius. (Ex. 1006 ¶¶ 142-146.) The Harada corner portions are arc-shaped with radius R. (*Id.* ¶ 146.) Because of the mathematical correlation between space factor, *R*, and *D*, using the space factor disclosed by Harada (96%-99%) necessarily results in a sectional area ratio of at least 1.15. (*Supra* Section IV.B.1; *see* Ex. 1006 ¶¶ 130-37, 147-51.) Therefore, Harada anticipates claim 2 under 35 U.S.C. §§ 102(a) and (b).

(b) Claims 3 and 4

Independent claim 3 of the '888 patent differs from claim 1 in only one respect. Instead of including a limitation relating to the "area ratio," claim 3 requires that the "overall length of an outer circumference of the section of said wire having said chamfers is at least 1.09 times as long as circumference of a circle having a diameter which is the same as the length of one side of said square." Harada inherently discloses this ratio by disclosing a square wire with corners and a space factor of 96% to 99% that will always mathematically result in a length ratio that is at least 1.09 times greater

than the circumference of a reference circle. (*Id.* ¶¶ 152-65; *supra* IV.B.1.) Therefore, Harada anticipates claim 3 under 35 U.S.C. §§ 102(a) and (b).

Claim 4 of the '888 patent, which depends from claim 3, adds the limitations that the chamfers of the square wire be arc-shaped and that the ratio of the overall length around the square with arc-shaped chamfers be "at least 1.09 times as long as circumference of a circle having a diameter which is the same as the length of one side of" the resulting wire. Harada discloses arc-shaped chamfers. (Ex. 1005 ¶¶ 0005, 0009, 0014, 0016, Fig. 1; Ex. 1006 ¶¶ 143-46.) As calculated for claim 3, the resulting wire has an overall length around the perimeter of the wire of 1.21 times longer than the circumference of the reference wire, which meets the requirement of a length ratio of "at least 1.09 times." (Ex. 1006 ¶¶ 159, 166-72.) Therefore, claim 4 is anticipated by Harada under 35 U.S.C. §§ 102(a) and (b).

(c) Claims 5 Through 8

Harada discloses that the length of the side of a wire of 1 mm or less. (*Id.* ¶¶ 173-77.) Four embodiments of Harada use a die with vertical and horizontal sides of length 0.200 mm, (Ex. 1005 ¶¶ 0011-0014), and in one instance, a square wire is produced of "0.26 mm x 0.26 mm." (*Id.* ¶ 0014.) Additionally, in its fifth embodiment, Harada discloses "a square copper wire (1) with a length of 0.200 mm on the side thereof, obtained through the first embodiment." (*Id.* ¶ 0015.) Each of these disclosures meets the limitation of a length of one side of the square being 1 mm or

less. (Ex. 1006 ¶¶ 173-78.) Therefore, claims 5 through 8 are anticipated by Harada under 35 U.S.C. §§ 102(a) and (b).

The claim chart below along with the referenced Declaration of Dr. Richard W. Klopp (Ex. 1006) demonstrate in further detail how Harada anticipates claims 1-8 of the '888 patent.

Claims of the '888 Patent	**Harada**
1. A wire for use in a coil, said wire having a square sectional shape,	Harada discloses this claim element. (*See* Ex. 1006 ¶¶ 123-26.) ¶ 0001: "The present invention relates to a method for manufacturing an angular conductor, an angular conductor, and an angular insulated wire, to be used as an insulated wire for coil winding." *See also* ¶¶ 0005, 0008, 0009, 0016. ¶ 0005: "A first aspect of the present invention is a method for manufacturing an angular conductor, wherein a drawing process is carried out using dice whereof the shape of the hole is angular to process a conductor that has a round cross-sectional shape into an angular shape to produce an angular conductor that has a vertical and horizontal cross-sectional dimensional ratio of between 1:1 and 1:2." *See also* Fig. 1. ¶ 0014: "a round copper wire with a bare wire diameter of 0.32 mm, to produce a 0.26 mm x 0.26 mm essentially square wire"
wherein chamfers are provided at four corners in the section of the square, and	Harada discloses this claim element. (*See* Ex. 1006 ¶¶ 127-28.) ¶ 0005: "In the method for manufacturing the angular conductor according to this first aspect, the angular conductor will have a vertical and horizontal cross-sectional dimensional ratio of between 1:1 and 1:2, and the R parts of the corner portions will be small, which is beneficial in

	improving the space factor." *See also* ¶¶ 0009, 0014, 0016, Fig. 1. ¶ 0014: "Note that at this stage the corner portions assumed an R shape." ¶ 0010: "In this figure 1, 1 is an angular copper (and angular copper wire), and 2 is a corner portion."
sectional area of said wire having the chamfers is at least 1.15 times as large as that of a circle having a diameter which is the same as the length of one side of said square.	Harada discloses this claim element. (*See* Ex. 1006 ¶¶ 129-38.) ¶ 0002: "Given this, in order to improve the space factor when winding coils the cross-sectional shapes of the conductors have been changed from round shapes (round conductors) to flat angular shapes (flat angular conductors), and the space factors have improved commensurately (from, for example, 91% to 96%)." ¶ 0014: "Moreover, the rounded parts at the corner portions (2) were smaller in the square copper wires (1) obtained through the first through fourth embodiments, which is beneficial to improving the space factor (improving to about 99%).
2. A coil wire according to claim 1, wherein arc-shaped chamfers are provided at four corners in the section of the square, and	Harada discloses this claim element. (*See* Ex. 1006 ¶¶ 141-46.) ¶ 0005: "In the method for manufacturing the angular conductor according to this first aspect, the angular conductor will have a vertical and horizontal cross-sectional dimensional ratio of between 1:1 and 1:2, and the R parts of the corner portions will be small, which is beneficial in improving the space factor." *See also* 0009, 0014, 0016, Fig. 1. ¶ 0014: "Note that at this stage the corner portions assumed an R shape." ¶ 0010: "In this figure 1, 1 is an angular copper (and angular copper wire), and 2 is a corner portion."
length of the radius of	Harada discloses this claim element. (*See* Ex. 1006 ¶¶ 147-

an arc of said arc-shaped chamfer is set so that the sectional area of said wire having said chamfers is at least 1.15 times as large as that of a circle having a diameter which is the same as the length of one side of said square.	50.) ¶ 0002: "Given this, in order to improve the space factor when winding coils the cross-sectional shapes of the conductors have been changed from round shapes (round conductors) to flat angular shapes (flat angular conductors), and the space factors have improved commensurately (from, for example, 91% to 96%)." ¶ 0014: "Moreover, the R parts at the corner portions (2) were smaller in the square copper wires (1) obtained through the first through fourth embodiments, which is beneficial to improving the space factor (improving to about 99%).
3. A wire for use in a coil, said wire having a square sectional shape,	Harada discloses this claim element. (*See* Ex. 1006 ¶¶ 123-28,153-154.) ¶ 0001: "The present invention relates to a method for manufacturing an angular conductor, an angular conductor, and an angular insulated wire, to be used as an insulated wire for coil winding." *See also* ¶¶ 0005, 0008, 0009, 0016. ¶ 0005: "A first aspect of the present invention is a method for manufacturing an angular conductor, wherein a drawing process is carried out using dice whereof the shape of the hole is angular to process a conductor that has a round cross-sectional shape into an angular shape to produce an angular conductor that has a vertical and horizontal cross-sectional dimensional ratio of between 1:1 and 1:2." *See also* Fig. 1. ¶ 0014: "a round copper wire with a bare wire diameter of 0.32 mm, to produce a 0.26 mm x 0.26 mm essentially square wire."
wherein chamfers are provided at four corners in the section of the square, and	Harada discloses this claim element (*See* Ex. 1006 ¶¶ 123-28,153-154.) ¶ 0005: "In the method for manufacturing the angular conductor according to this first aspect, the angular conductor will have a vertical and horizontal cross-sectional dimensional ratio of between 1:1 and 1:2, and the R parts of

	the corner portions will be small, which is beneficial in improving the space factor." *See also* ¶¶ 0009, 0014, 0016, Fig. 1. ¶ 0014: "Note that at this stage the corner portions assumed an R shape." ¶ 0010: "In this figure 1, 1 is an angular copper (and angular copper wire), and 2 is a corner portion."
overall length of an outer circumference of the section of said wire having said chamfers is at least 1.09 times as long as circumference of a circle having a diameter which is the same as the length of one side of said square.	Harada discloses this claim element. (*See* Ex. 1006 ¶¶ 155-64.) ¶ 0002: "Given this, in order to improve the space factor when winding coils the cross-sectional shapes of the conductors have been changed from round shapes (round conductors) to flat angular shapes (flat angular conductors), and the space factors have improved commensurately (from, for example, 91% to 96%)." ¶ 0014: "Moreover, the R parts at the corner portions (2) were smaller in the square copper wires (1) obtained through the first through fourth embodiments, which is beneficial to improving the space factor (improving to about 99%).
4. A coil wire according to claim 3, wherein arc-shaped chamfers are provided at four corners in the section of the square, and	Harada discloses this claim element. (*See* Ex. 1006 ¶¶ 167-68.) ¶ 0005: "In the method for manufacturing the angular conductor according to this first aspect, the angular conductor will have a vertical and horizontal cross-sectional dimensional ratio of between 1:1 and 1:2, and the rounded parts of the corner portions will be small, which is beneficial in improving the space factor." *See also* ¶¶ 0009, 0014, 0016, Fig. 1. ¶ 0014: "Note that at this stage the corner portions assumed an R shape." ¶ 0010: "In this figure 1, 1 is an angular copper (and angular copper wire), and 2 is a corner portion."

length of the radius of an arc of said arc-shaped chamfer is set so that overall length of an outer circumference of the section of said wire having said chamfers is at least 1.09 times as long as circumference of a circle having a diameter which is the same as the length of one side of said square.	Harada discloses this claim element. (*See* Ex. 1006 ¶¶ 169-71.) ¶ 0002: "Given this, in order to improve the space factor when winding coils the cross-sectional shapes of the conductors have been changed from round shapes (round conductors) to flat angular shapes (flat angular conductors), and the space factors have improved commensurately (from, for example, 91% to 96%)." ¶ 0014: "Moreover, the R parts at the corner portions (2) were smaller in the square copper wires (1) obtained through the first through fourth embodiments, which is beneficial to improving the space factor (improving to about 99%).
5. A coil wire according to claims 1, wherein length of one side of said square is 1 mm or less.	Harada discloses this claim element. (*See* Ex. 1006 ¶¶ 173-78.) ¶ 0015: "An angular polyurethane copper wire (not shown) was manufactured by providing an insulating coating film to a thickness of 0.010 mm through enamel coating of a polyurethane coating onto the outer circumference of a square copper wire (1) with a length of 0.200 mm on the side thereof, obtained through the first embodiment." ¶ 0011: "For the angular die, five angular dice whereof the hole shapes of 0.200 mm both vertically and horizontally are used . . . ." *See also* ¶¶ 0012-0014. ¶ 0012: "die . . . to machine into an angular copper wire with a length of 0.200 mm on one side." *See also* ¶ 0013.
6. A coil wire according to claims 2, wherein length of one side of said square is 1 mm or less.	Same disclosures for claim 5.
7. A coil wire according to claims 3, wherein length of one side of said square is	Same disclosures for claim 5.

1 mm or less.	
8. A coil wire according to claims 4, wherein length of one side of said square is 1 mm or less.	Same disclosures for claim 5.

C. Harada and Sugita Are Not Redundant

While either Harada or Sugita can stand alone to anticipate claims 1-8, they do so by approaching the problem in different ways. Sugita discloses a die for creating square wires. The Sugita reference anticipates the '888 patent by providing dimensions of a die that necessarily result in a wire that satisfies the claimed ratios, as well as two examples of a wire drawn through a die with such dimensions that the wires mathematically meet all the claims of the '888 patent.

Whereas Sugita anticipates based on specifying the dimensions of a square wire with rounded corners, Harada anticipates based on providing the space factor of a square wire with rounded corners. The space factors disclosed in Harada necessarily result in wires that meet the claimed ratios, regardless of which set of dimensions are chosen for the square wire with rounded corners. Further, the '888 patent teaches generally that "an ideal square is preferable as a sectional shape," but small rounded corners are useful in overcoming some insulation problems of the "ideal square." (Ex. 1001 at 1:35-36.) Likewise, Harada seeks higher space factors, which approach the preferable ideal square, while maintaining small rounded corners beneficial to achieving a higher space factor. (Ex. 1005 ¶¶ 0003-0004.) Unlike Sugita's disclosure of a die used

for producing a square wire, Harada discloses the lengths of the side of the square wire.

Sugita approaches anticipation by disclosure of the dimensions of the square wire created from a die that satisfy the claimed ratios, whereas Harada anticipates based on a space factor that necessarily satisfies the claimed ratios. Therefore, Sugita and Harada are not redundant.

D. Claims 1-8 Are Obvious Under 35 U.S.C. § 103(a) over Sugita in view of Math Pocket Reference

To the extent that the PTAB does not find inherent in Sugita the limitations of area ratio and length ratio from claims 1 through 8 of the '888 patent, these claimed ratios would have been obvious. A POSITA would have been motivated to combine his or her knowledge from a basic geometry prior art reference, such as Math Pocket Reference,[8] with Sugita to meet the claimed ratio limitations. Even if Sugita does not expressly disclose the area ratio and length ratio from claims 1 through 8, Sugita discloses wire dimensions sufficient to calculate those ratios. Math Pocket Reference provides all the mathematical building blocks to calculate those ratios. (Ex. 1006 ¶ 182.)

The fundamental geometry to calculate the area ratio and length ratio from

[8] There are thousands of geometry books and references that teach basic geometry principles, any of which could easily act as a secondary obviousness reference. (Ex. 1006 ¶ 179.)

claims 1 through 8 is easily derived from the equations for perimeter and area of squares and circles, which have been known for centuries. (*Id.* ¶ 32.) Math Pocket Reference discloses this fundamental geometry, including, at a minimum, the following equations: area of a square, perimeter of a square, area of a circle, circumference of a circle, area of a sector, length of an arc, and area of a fillet. (Ex. 1010 at 314-19; Ex. 1006 ¶ 182.) Math Pocket Reference also discloses various uses of ratios. (Ex. 1010 at 314-19; Ex. 1006 ¶ 182.)

A POSITA would have been motivated to combine Sugita's teachings with Math Pocket Reference because both references involve geometry. (Ex. 1006 ¶ 181.) Sugita relates to various shapes, including, for example, dies and wires with square or rectangular cross-sections having arc-shaped corners with a radius R. (Ex. 1002 Abstract, ¶ 0001.) Sugita also teaches ratios of dimensions of its die. (Ex. 1002 Claim 8 and 9, ¶¶ 0006, 0023-0025, 0031, 0034.) Math Pocket Reference is a reference guide that includes all the equations needed to calculate the '888 patent ratios. (*See* Ex. 1010, at pp. 314-19; Ex. 1006 ¶ 182.) A POSITA would have been motivated to calculate the cross-sectional areas and perimeters of the Sugita wire, in part, because it would directly impact the conductivity of the wire and spacing issues for use in a coil, and a POSITA would turn to reference books to assist with these calculations. (Ex. 1006 ¶¶ 183-86.) Sugita's teachings of "high space efficiency" would further motivate a POSITA to use the geometric equations and formulas found in a reference, such as Math Pocket Reference, to calculate ratios from the dimensions of the Sugita wire to determine the

improvement from use of the Sugita wire as compared to a traditional circular wire. (Ex. 1002 ¶ 0002; Ex. 1006 ¶ 187-89.)

Claims 1 through 8 would be obvious over Sugita in view of Math Pocket Reference.

E. Claims 1-8 Are Obvious Under 35 U.S.C. § 103(a) over Harada in view of Math Pocket Reference

To the extent that the PTAB does not find inherent in Harada the limitations of area ratio and length ratio from claims 1 through 8 of the '888 patent, these claimed ratios would have been obvious. A POSITA would have been motivated to combine his or her knowledge from a basic geometry prior art reference, such as Math Pocket Reference, with Harada to meet the claimed ratio limitations. Although Harada does not expressly disclose the area ratio and length ratio from claims 1 through 8, it does disclose a space factor sufficient to determine that the Harada wire necessarily exceeds the value of the area and length ratios. (Ex. 1006 ¶ 192.) Math Pocket Reference provides the mathematical building blocks to determine that these ratios must be exceeded. (Ex. 1006 ¶ 193.)

As described above in Section IV.D, Math Pocket Reference discloses all the necessary equations to calculate the area ratio and length ratio needed for claims 1 through 8. (Ex. 1010 at 314-19; Ex. 1006 ¶ 179-89, 193-94.)

A POSITA would have been motivated to combine Harada's teachings with Math Pocket Reference because both references involve geometry. (Ex. 1006 ¶ 195.)

Harada discloses a square wire with arc-shaped corners that has a space factor of about 99%. (*Id.*; Ex. 1005 ¶ 0014.) A POSITA would know that Harada's space factor here is merely the ratio of the Harada wire's cross-sectional area to the area of an ideal square. (Ex. 1006 ¶ 196.) Harada also discloses ratios for a wire's dimensions. (Ex. 1005 claims 1 and 2, ¶¶ 0005, 0006, 0016.) Math Pocket Reference includes all the basic geometry equations that would be utilized to determine areas, perimeters, and ratios. (*See* Ex. 1010 at pp. 314-19; Ex. 1006 ¶ 197.)

A POSITA would have been motivated to use Math Pocket Reference, or any other math book with rudimentary geometry, to calculate the area ratio of 1.26 and minimum length ratio of 1.21 based on the 99% space factor disclosed by Harada. (Ex. 1006 ¶¶ 197-98, 201.) Harada discloses a space factor, which involves the ratio of a square wire with chamfers to an ideal square, and it also teaches the improvement in space factors by transitioning from a round wire to a square wire. (*Id.* ¶ 199.) Thus, a POSITA would be highly motivated to use the Math Pocket Reference to calculate the area ratio comparing the Harada wire to a reference round wire. (*Id.*) Harada teaches that "to improve the space factor when winding coils the cross-sectional shapes of the conductors have been changed from round shapes (round conductors) to flat angular shapes (flat angular conductors), and the space factors have improved commensurately (from, for example, 91% to 96%)." (Ex. 1005 ¶ 0002; Ex. 1006 ¶ 199.) A POSITA would also be motivated to calculate the length ratio to determine spacing and material issues. (Ex. 1006 ¶ 200.) Based on the foregoing, claims 1 through 8 would be obvious

over Sugita in view of Math Pocket Reference.

F. Claims 1-8 Are Obvious Under 35 U.S.C. § 103(a) over Sugita in view of MWSWire

If the PTAB fails to find that Sugita discloses the length of the side of the square wire and a radius that can be set to obtain the claimed length and area ratios, it should still find claims 1-8 obvious in light of MWSWire. First, claims 2, 4, 6 and 8 would be obvious based on Sugita and the disclosures of radii and lengths from MWSWire. Second, claims 1 and 3 would be obvious since their dependent claims are obvious. (*Callaway Golf Co. v. Acushnet Co.*, 576 F.3d 1331, 1344 (Fed. Cir. 2009) ("A broader independent claim cannot be nonobvious where a dependent claim stemming from that independent claim is invalid for obviousness.").) Third, claims 5-8 would be obvious since these claims are "an obvious matter of design choice to the size of the conductor, since such a modification would have involved a mere change in the size of a component to meet desired electrical/mechanical characteristics[, and a] change in size of a conductor is generally recognized as being within the level of ordinary skill in the art for the purpose of current carrying capability. *In re Selmi*, 156 F.2d 96, 70 USPQ 197 (CCPA 1946) *In re Greider et al.*, 29 C.C.P.A. (Patents) 1079, 129 F.2d 568 [54 USPQ 139].) 784 (Fed. Cir. 1985); *In re Kule* 188 USPQ 7 (CCPA 1975)." (Ex. 1014 at p. 4 ¶ 4.)

MWSWire discloses both the radius and lengths of over twenty square shaped wires with arc-shaped corners having different sizes. (Ex. 1012 Table; Ex. 1006 ¶ 207.)

MWSWire contains a chart and description from a website archived by the Internet Archive from October 1999. (Exs. 1011-1013.) The information on this website appears substantially unchanged to the present day on MWSWire.com. (Ex. 1006 ¶ 207.) The chart lists the sizes of wire, including the bare side dimensions and the corner radii of square shaped wires with arc-shaped corners. (*Id.*) The sizes are defined in terms of a unit called AWG (American Wire Gauge), which is a standardized wire size system used since the nineteenth century. (*Id.*)

The MWSWire reference provides square shaped wires for "specialty coil and motor windings." (Ex. 1011; Ex. 1006 ¶ 205.) Use of the wire sizes listed in the MWSWire "allows design engineers to create compact coils and small motors that deliver more power in less space." (Ex. 1011; Ex. 1006 ¶ 206.)

A POSITA would have been motivated to combine Sugita's teachings with MWSWire because both references are related to wires having a square cross-sectional area for use in a coil. (Ex. 1006 ¶¶ 205-207.) Sugita relates to the dies used for creating the type of wires disclosed by the MWSWire chart. (Ex. 1002 Abstract; *see* Ex. 1012.) Both Sugita and MWSWire teach space efficiency, and as a result, a POSITA would be motivated to combine these references, taking dimensions from MWSWire to create Sugita's wires. (Ex. 1006 ¶ 206.) Further, a POSITA would be motivated to use dimension from the list of standardized wire sizes from MWSWire since they boast "more power in less space." (Ex. 1011 at p. 1; Ex. 1006 ¶ 206.)

It would have been obvious to a POSITA to select from any of the various

dimensions listed in a table such as the MWSWire reference and combine it with Sugita, because these wire sizes and tables were well-known and available for use by those in the industry prior to the '888 patent. (Ex. 1006 ¶ 211; Ex. 1012.) For example, from MWSWire AWG 21 has a length D of 0.0285 in (0.7239 mm) with a corner radius of 0.006 in (0.1524 mm), resulting in an area ratio of 1.22 and a length ratio of 1.16. (Ex. 1006 ¶ 226) It was common practice to consult such tables of standardized wires to see what was currently available on the market. (*Id.* ¶¶ 212-14.) A POSITA would consult a table, such as the one in MWSWire, if he or she needed to use, sell, buy, or manufacture a wire of varying dimensions, for use in a coil, and especially if the POSITA sought to improve upon coil wire. (Ex. 1006 ¶¶ 213-14.) A POSITA at the time of Sugita would look to charts such as those in MWSWire. (Ex. 1006 ¶¶ 211-14.)

Based on the foregoing, claims 1-8 are obvious over Sugita in view of MWSWire. (Ex. 1006 ¶¶ 203-217.)

G. Claims 1-8 Are Obvious Under 35 U.S.C. § 103(a) over Harada in view of MWSWire

If the PTAB finds that the use of a space factor in Harada does not inherently discloses a radius that can be set to obtain the length and area ratios, it should still find claims 1-8 obvious in light of Harada and MWSWire. Claims 2, 4, 6 and 8 are obvious when combined with the radii from MWSWire, and then necessarily claims 1 and 3 would be obvious as the broader claims. (*Callaway Golf Co.*, 576 F.3d at 1344.) Also,

claims 5-8 are obvious since these claims involve "an obvious matter of design choice to the size of the conductor . . . ." (Ex. 1014 at p. 4, ¶ 4.)

Harada discloses a square wire with arc-shaped corners with a space factor of 96% to 99%. (Ex. 1005 ¶ 0002, 0014) A POSITA would be motivated to combine Harada with the MWSWire reference to assign those MWSWire dimensions to the R parts of the corner portions in order to achieve Harada's space factor of 96% or greater and the claimed ratios, such as would be achieved by AWG 21, 22 and 26-33. (*See* Ex. 1006 ¶¶ 223 (Table 1), 227.)

Whereas Harada discloses the "R parts of the corner portions," MWSWire discloses an entire chart of radii for the corners of standardized wire sizes. (Ex. 1012; Ex. 1006 ¶¶ 226-27.) In fact, all the wires listed in this chart (AWG 15-35) exceed the ratios stated in claims 1-8 of the '888 patent. (Ex. 1006 ¶ 226.) Every wire on the MWSWire chart has a radius for the corner sections. (Ex. 1012.) Further, like Harada the MWSWire reference is for wires to be used in coils and to allow "design engineers to create compact coils and small motors that deliver more power in less space." (Ex. 1011; Ex. 1006 ¶¶ 220-21.)

A POSITA would have been motivated to combine Harada's teachings with MWSWire because both references are related to wires for use in a coil having a square cross-sectional area. (Ex. 1005 ¶ 0005, Abstract, Fig. 1; Exs. 1011-1012.) Harada teaches the idea of smaller wires to improve efficiency, as does MWSWire, thus motivating a POSITA to use the dimensions in MWSWire for the wires made in

accordance with Harada. (Ex. 1005 ¶¶ 0002, 0005; Ex. 1011; *see* Ex. 1006 ¶¶ 220, 228-30.) A POSITA would have selected and created from MWSWire any one of the wire sizes AWG 19-35, all of which have the requisite dimensions and ratios, and combined it with Harada. (Ex. 1006 ¶¶ 226, 230.) In fact, it was common practice to manufacture wires in sizes that conform to one of the standard sizes. (Ex. 1006 ¶ 231.) Thus, a POSITA would have consulted such a table of standardized wires as that found in MWSWire to select one of the standard sizes and use dimensions that correspond to the selected size. (*Id.*) A POSITA would also have consulted such a chart if inventing a wire with improved space factor, or just needed to purchase or use such a wire. (*Id.*)

Based on the foregoing, claims 1-8 are obvious over Harada in view of MWSWire. (Ex. 1006 ¶¶ 219-32.)

H. Claims 1-8 Are Obvious Under 35 U.S.C. § 103(a) over Harada in view of Nakagawa

If the PTAB finds that Harada does not disclose ratios requiring a radius based on a space factor, or that it is not obvious in light of MWSWire, then it should still find claims 1-8 obvious in light of Harada and Nakagawa. Claims 2, 4, 6 and 8 are obvious in light of Nakagawa, and claims 1 and 3 would be necessarily obvious as the broader claims. (*Callaway Golf Co.*, 576 F.3d at 1344.) Also, claims 5-8 would be obvious since these claims involve "an obvious matter of design choice to the size of the conductor . . . ." (Ex. 1014 p. 4, ¶ 4.)

Claims 2, 4, 6 and 8 of the '888 patent require that certain ratios are achieved in part by setting the radius of the corners. Harada discloses a square shaped wire for use in a coil with "R parts of the corner portions," (Ex. 1005 ¶¶ 0005), and a space factor of 96% to about 99%. (*See id.* ¶¶ 0002, 0014.) Harada seeks a larger space factor to "improve the performance of electrical instruments, such as motors." (*Id.* ¶ 0002.) Similarly, Nakagawa discloses a coil wire "with a cross section in the shape of a square having corners of a radius with a certain curvature," (Ex. 1003 at p. 3, lines 3-6), and a space factor "from about 96 % to about 98 %." (*Id.* at p. 6, lines 8-9.) Nakagawa teaches that its wire "contributes to improvement of productivity and quality of the voice coil." (*Id.* at p. 6, line 7.)

The only difference between the Harada reference and Nakagawa reference is perhaps solely based on the translations in which Harada discloses "R parts of the corner portions" whereas Nakagawa discloses "corners of a radius with a certain curvature." (Ex. 1005 ¶¶ 0003, 0005, 0008, 0009, 0014, 0016; Ex. 1003 at p. 3, lines 3-6.) If one does not accept the standard interpretation of R parts to be radius, a POSITA would still have been motivated to combine Harada with Nakagawa to assign a radius to the R parts of the corner portions and adjust it to obtain the desired space factor.

A POSITA would have been motivated to combine Harada's teachings with Nakagawa because both references are related to wires for use in a coil having a square cross-sectional area. (Ex. 1006 ¶ 235; Ex. 1005 ¶ 0005; Ex. 1003 p. 3, ¶ 2.) Harada

relates to the manufacturing of wires with an increased space factor of about 99%, just like Nakagawa's increased space factor of about 98%. (Ex. 1005 ¶ 0014; Ex. 1003 at p. 6, lines 8-9.) A POSITA seeking to improve the space factor of its coil wire would look to earlier teachings of coil wires with improved space factors, such as the Nakagawa reference from 1989, in order to further improve upon the wire. (Ex. 1006 ¶ 241.)

The increasing demands of technology would have led a POSITA to seek out other solutions to the need for smaller coils. (*Id.* ¶ 242.) Nakagawa taught that "increasing the density of electronic components has been required." (Ex. 1003 p. 6, line 10.) Harada taught that "advances in technology have led to demands for improved space factor and insulating property in order to reduce the weight and improve the performance of electrical instruments." (Ex. 1005 ¶ 0002.) A POSITA at the time of Harada would have looked at solutions in other publications such as Nakagawa to solve the problem of smaller components and windings. (Ex. 1006 ¶ 242.)

When a POSITA found a solution in Nakagawa, the POSITA would apply a radius as done in Nakagawa to the corners in the Harada wire. (*Id.* ¶ 243.) A POSITA would have known that the arc-shaped corners of the Harada wire should be considered broadly and would encompass a corner with a radius. (*Id.* ¶ 244.) Further, the POSITA would understand that the simplest way to calculate the space factor would be to either have linear corners or corners with a radius. (*Id.* ¶ 245.) Finally, since the standard practice in the manufacture of square wires with rounded corners

was to have a corner with a radius, as shown by Nakagawa over a decade earlier, a POSITA would naturally assign a radius to the arc-shaped corners of the Harada wire. (*Id.* ¶ 246.)

Based on the foregoing, claims 1-8 are obvious over Harada in view of Nakagawa. (Ex. 1006 ¶¶ 233-47.)

VI. MANDATORY NOTICES PURSUANT TO 37 C.F.R. § 42.8(A)(1)

Pursuant to 37 C.F.R. § 42.8(a)(1), the mandatory notices identified in 37 C.F.R. § 42.8(b) are provided below as part of this Petition.

A. C.F.R. § 42.8(b)(1): Real Party-In-Interest

Mitsubishi Cable Industries, Ltd. and Mitsubishi Cable America, Inc. are the real parties-in-interest.

B. C.F.R. § 42.8(b)(2): Related Matters

The '888 patent is currently the subject of a patent infringement lawsuit brought by the assignee of the '888 patent, Goto Denshi Co., Ltd. (*See Goto Denshi Co., Ltd., et al. v. Mitsubishi Cable Industries, Ltd., et al.*, U.S. District Court for the Central District of California, Civil Action No. 2:14-cv-09815 (C.D. Cal. Dec. 23, 2014).) This judicial matter may affect decisions made in this proceeding.

C. C.F.R. § 42.8(b)(3) and (4): Lead and Back-up Counsel and Service Information

Mitsubishi provides the following designation of counsel:

Lead Counsel	Back-up Counsel
S. Christian Platt Reg. No. 46,998 JONES DAY 12265 El Camino Real, Suite 200 San Diego, CA 92130 (858) 314-1156 cplatt@jonesday.com	Douglas L. Clark Reg. No. 68,443 JONES DAY 3161 Michelson Dr. Ste 800 Irvine, CA 92612 (949) 553-7577 dlclark@jonesday.com

Pursuant to 37 C.F.R. § 42.10(b), a Power of Attorney accompanies this Petition. Please address all correspondence to lead and back-up counsel at the San Diego address. Mitsubishi consents to e-mail service at the addresses listed above.

VII. CONCLUSION

Petitioner respectfully requests that the Patent Office order an *Inter Partes* Review trial and proceed to cancel claims 1-8 of the '888 patent.

Respectfully submitted,

Date: April 24, 2015

By: /S. Christian Platt/
S. Christian Platt, Reg. No. 46998
Douglas L. Clark, Reg. No. 68443
JONES DAY
12265 El Camino Real, Suite 200
San Diego, CA 92130
(858) 314-1156

CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 7,238,888, including all Exhibits, was served on April 24, 2015 via Express Mail delivery directed to the attorney of record for the patent at the following addresses:

Ladas & Parry LLP
224 South Michigan Avenue
Suite 1600
Chicago, IL 60604
Patent owner's correspondence address of record

and

Heedong Chae, Esq.
East West Law Group
3600 Wilshire Boulevard, Suite 702
Los Angeles, CA 90010
Attorney of record for Plaintiff in concurrent litigation matter

Date: April 24, 2015

/s/Douglas L. Clark
Douglas L. Clark

EXHIBIT LIST

EXHIBIT NO.	TITLE
1001	U.S. Patent No. 7,238,888 ("the '888 patent")
1002	JP Publ. No. 2003-245711 ("Sugita")
1003	JP Publ. No. H01-176315 ("Nakagawa")
1004	Excerpt from the file history of the '888 patent: Information Disclosure Statement (IDS) Form (SB08) dated March 29, 2006 with Foreign Reference H01-176315
1005	JP Pat. Publ. No. 2002-260461 ("Harada")
1006	Declaration of Dr. Richard W. Klopp Under 37 C.F.R. § 1.68 in Support of Petition for *Inter Partes* Review of U.S. Patent No. 7,238,888
1007	*Curriculum vitae* of Dr. Richard W. Klopp
1008	Excerpts from original application and appeal of the rejection of the Japanese Application No. 2003/384209, Appeal No. Objection 2006-3309 ("Japanese Appeal"): (1) Claims 1-5 from application dated 11/13/2003, (2) Notice of Reasons for Rejections drafted 5/8/2008, (3) Notice of Conclusion of Appeal Examination dated 10/20/2008, and (4) Decision on Appeal dated 11/4/2008
1009	Excerpts from the Japanese Appeal: Request for Appeal dated 5/23/2006
1010	T.J. Glover, Pocket Ref (Sequoia Publishing 2001) (1989) ("Math Pocket Reference")

1011	MWS Wire Industries, Microsquare Magnet Wire, http://web.archive.org/web/19991013044251/http://www.mwswire.com/microsq.htm (last visited April 10, 2015).
1012	MWS Wire Industries, Copper Microsquare Information, http://web.archive.org/web/19991013054205/http:/www.mwswire.com/microsq1.htm (last visited April 10, 2015).
1013	Affidavit of Christopher Butler dated April 3, 2015 attaching Wayback Machine web pages Exs. 1011 and 1012.
1014	Excerpt from the file history of the '888 patent: Final Office Action Summary dated 11/22/2006.
1015	Steel Wire Handbook, Vol. 3, The Wire Association, pp. 23-31 (1972)
1016	T.E. French and C.J. Vierck, Engineering Drawing & Graphic Technology, 1978, pp. 361-363 (McGraw-Hill, 1978)
1017	M.R. Spiegel, Mathematical Handbook, Schaum's Outline Series in Mathematics (McGraw-Hill, 1968) ("Schaum")
1018	E. Oberg, et al., Machinery's Handbook 26th Edition (Industrial Press, 2000) ("Oberg")
1019	L.S. Marks, Mechanical Engineers' Handbook (McGraw-Hill, 1951) ("Marks")
1020	Metals Handbook 9th Edition, Vol. 14 – Forming and Forging, p. 2 (ASM International, 1988)
1021	IEEE 100 The Authoritative Dictionary of IEEE Standards Terms 186 (7th ed., 2000)

1022	McGraw-Hill Dictionary of Scientific and Technical Terms p. 1779 (4th ed. 1989)
1023	U.S. Patent No. 6,623,339 ("Igarashi")
1024	European Patent No. EP 1122030 A2 ("Takahashi")
1025	U.S. Patent Application US 2007/0037124 A1 ("Honkura")
1026	C.R. Underhill, Solenoids Electromagnets and Electromagnetic Windings (D. Van Nostrand, 1910) ("Underhill")
1027	Metals Handbook 8th Edition, Vol. 2 – Machining (ASM International, 1976, p. 227-233)
1028	H. Pender and W.A. Del Mar, Handbook for Electrical Engineers, (John Wiley, 1922, p. 1434) ("Pender")