IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HENGDIAN GROUP DMEGC MAGNETICS CO., LTD,
ZHEJIANG INNUOVO MAGNETICS CO., LTD.,
ZHEJIANG DONGYANG EAST MAGNETIC RARE EARTH CO., LTD.,
Petitioners

v.

HITACHI METALS, LTD.
Patent Owner.

U.S. Patent No. 6,461,565 to Tokuhara
Issue Date: October 8, 2002
Title: Method of Pressing Rare Earth Alloy Magnetic Powder

Inter Partes Review No.: IPR2017-01312

Petition for *Inter Partes* Review of U.S. Patent No. 6,461,565 Under 35 U.S.C. §§ 311-319 and 37 C.F.R. §§ 42.1-.80, 42.100-.123

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EXHIBIT LIST

Exhibit #	***Description***
1001	U.S. Patent No. 6,461,565 to Tokuhara, entitled "Method of Pressing Rare Earth Alloy Magnetic Powder"
1002	Office Action of January 9, 2002 in U.S. Patent Application No. 09/801,096
1003	U.S. Patent No. 6,261,515 to Ren, entitled "Method for Producing Rare Earth Magnet Having High Magnetic Properties"
1004	U.S. Patent No. 5,383,978 to Yamamoto, entitled "Alloy Ingot for Permanent Magnet, Anisotropic Powders for Permanent Magnet, Method for Producing Same and Permanent Magnet"
1005	U.S. Patent No. 5,666,635 to Kaneko, entitled "Fabrication Method for R-Fe-B Permanent Magnets"
1006	Japanese Patent No. JP 63-033-505 to Ota, entitled "Method for manufacturing raw material powder for permanent magnet material" and Certified Translation
1007	U.S. Patent No. 6,299,832 to Kohara, entitled "Process and Apparatus for Supplying Rare Earth Metal-Based Alloy Powder"
1008	U.S. Patent No. 5,093,076 to Young, entitled "Hot Pressed Magnets in Open Air Presses"
1009	Lawrence A. Wood, *The Use of Dew-Point Temperature in Humidity Calculations*, Journal of Research of the National Bureau of Standards – C. Engineering and Instrumentation Vol. 74C, Nos. 3 and 4, July-December 1970
1010	Declaration of John Ormerod, Ph.D.

1011	HHE Report No. HETA-88-166-1944, Hoeganaes Magnetic Materials, Rancocas, New Jersey, by Hales-TR et al.
1012	Reserved
1013	U.S. Patent No. 5,167,914 to Fujimura, entitled "Rare Earth Magnet Having Excellent Corrosion Resistance"
1014	J. E. Flinn, Rapid Solidification Technology For Reduced Consumption of Strategic Materials, Noyes Publications (1985)
1015	U.S. Patent No. 5,145,624 to Croft, entitled "Pressing of Whiteware Ceramic Articles"
1016	J. Ormerod, *The Physical Metallurgy and Processing of Sintered Rare Earth Permanent Magnets*, Journal of the Less-Common Metals, 111 (1985) 49-69
1017	Shouzeng Zhou et al., *Effect of Environmental Retention Time of NdFeB Magnetic Particles on Structure and Properties of Sintered Magnet*, Journal of Magnetic Materials and Devices Vol. 24, Issue 2, April 1993 and Certified Translation
1018	US. Patent 5,085,828 to Shain et al., entitled "Cold Press Die Lubrication Method"
1019	Amendment of April 5, 2002 in U.S. Patent Application No. 09/801,096
1020	Reserved
1021	Original Claims filed on March 8, 2001 in U.S. Patent Application No. 09/801,096
1022	Notice of Allowance of July 2, 2002 in U.S. Patent Application No. 09/801,096
1023	CV of John Ormerod, Ph.D.

1024	U.S. Patent 5,527,504 to Kishimoto, entitled "Powder Mixture for Use in Compaction to Produce Rare Earth Iron Sintered Permanent Magnets"
1025	Anthony V. Arundel et al., *Indirect Health Effects of Relative Humidity in Indoor Environments*, Environmental Health Perspectives Vol. 65, pp. 351-361, 1986
1026	Olli Seppanen et al., *Control of Temperature for Health and Productivity in Offices*, June 2004

I. INTRODUCTION

Hengdian Group DMEGC Magnetics Co., Ltd., Zhejiang Innuovo Magnetics Co., Ltd., and Zhejiang Dongyang East Magnetic Rare Earth Co., Ltd. ("Petitioner") petitions for *Inter Partes* Review, seeking cancellation of claims 1-12 ("challenged claims") of U.S. Patent No. 6,461,565 B2 ("the '565 patent") (EX1001), which according to the current records of the USPTO is assigned to Hitachi Metals, Ltd. ("Patent Owner").

II. OVERVIEW

The '565 patent relates to a method for producing a rare earth permanent magnet using conventional temperature and humidity ranges in a controlled environment. The Patent Owner took a widely known characteristic of rare earth alloys, i.e., their susceptibility to oxidation based on the amount of H_2O and O_2 in the air and combust, and merely curated specific temperature and humidity ranges to reduce the oxidation and combustion.

The method posed by the '565 patent had already been evaluated and proven successful in producing a rare earth alloy magnet. The claimed ranges were not only used in experiments, but in every day manufacturing facilities that had an open-air environment. The temperature and humidity ranges claimed are consistent with working environments for humans and were utilized well before the '565 patent.

Therefore the Patent Owner's alleged invention is merely the standard work environment of the industry, and is anticipated and obvious in light of the prior art.

III. STANDING (37 C.F.R. § 42.10(a); PROCEDURAL STATEMENTS)

Petitioner certifies: that (1) the '565 patent is available for IPR; and (2) Petitioner is not barred or estopped from requesting IPR of any claim of the '565 patent on the grounds identified herein. This Petition is filed in accordance with 37 C.F.R. § 42.106(a). Filed herewith are a Power of Attorney and an Exhibit List pursuant to § 42.10(b) and § 42.63(e). The required fee is paid through online credit card, and the Office is authorized to charge any fee deficiencies and credit overpayments to Deposit Acct. No. 160605(Customer ID No. 00826).

IV. MANDATORY NOTICES (37 C.F.R. § 42.8(a)(1))

A. Real Party-In-Interest (37 C.F.R. § 42.8(b)(1))

The real party in interest is Hengdian Group DMEGC Magnetics Co., Ltd. Zhejiang Innuovo Magnetics Co., Ltd., and Zhejiang Dongyang East Magnetic Rare Earth Co., Ltd.

B. Notice of Related Matters (37 C.F.R. § 42.8(b)(2))

The '565 patent was previously asserted in the International Trade Commission, *In the Matter of Certain Sintered Rare Earth Magnets, Methods of Making Same and Products Containing Same*, Investigation No. 337-TA-855 ("the 855 Investigation"). The Administrative Law Judge ("ALJ") in the 855 Investigation issued a claim construction order involving the challenged claims of the '565 patent. Following issuance of the claim construction order, the Patent Owner withdrew its complaint and the investigation was terminated prior to any adjudication of validity.

C. Designation of Lead and Back-Up Counsel and Service (37 C.F.R. § 42.8(b)(3), 42.8(b)(4) and 42.10(a)-(b))

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Pursuant to 37 C.F.R. § 42.10(b), a Power of Attorney accompanies this petition.

V. STATEMENT OF THE PRECISE RELIEF REQUESTED AND THE REASONS THEREFORE (37 C.F.R. § 42.22(a))

Petitioner requests IPR and cancellation of claims 1-12. Petitioner's full statement of the reasons for the relief requested is set forth in detail below.

VI. THE '565 PATENT

The '565 patent was filed March 8, 2001 and allegedly stems from Japanese Patent 2000-062921, thus providing a potential priority date of March 8, 2000.

At a high level, the challenged claims of the '565 patent are directed toward "[a] method of forming a green compact of a rare earth alloy magnetic powder." EX1001, Claims 1-2; EX1010, ¶19. Conventionally, a rare earth alloy sintered magnet is produced by first melting raw materials (e.g., neodymium, iron, boron, cobalt, etc.); pouring the melt onto a rotating roll to form an alloy strip; cooling the alloy strip at a relatively rapid rate; pulverizing the alloy strip into a magnetic alloy powder; pressing and then compacting the alloy powder into a "green compact;" and finally, subjecting the green compact to sintering and aging processes. EX1001, 1:10-15; EX1010, ¶19. The '565 patent focuses on one step in the manufacturing process: pressing and then compacting the alloy powder into a green compact. EX1010, ¶20.

The '565 patent purports to provide "a method of making a green compact of a rare earth alloy magnetic powder in such a manner as to avoid [] combustion accidents and to attain superior magnetic properties even when the powder is easily oxidizable." EX1001, 2:49-54; EX1010, ¶20. The inventors of the '565 patent were aware of the common known fact that "the oxidizability of a rare earth alloy powder is greatly affected by the temperature and humidity of an ambient gas before, during, and after the powder is pressed in a compacting process, and so is controllable by adjusting these conditions." EX1001, 4:12-16; EX1010, ¶21. Using this common knowledge, Applicant performed experiments and determined that the environment most preferable for pressing has a temperature range of 15°C to 25°C, and a relative humidity in the range of 40% to 55% (*id*. at 9:60-67), created using a standard room air conditioner (*id.* at 18-26). EX1010, ¶¶21-22.

A. State of the Art

For years, rare earth magnetic powders have been produced and compacted in a temperature and humidity controlled environment. EX1011, 2; EX1010, ¶¶25-27; EX1003, 2:20-40; EX1017, 5. To prevent spontaneous combustion of the crushed metal, "[t]he crushing and blending processes occur in a temperature and humidity controlled room ("powder room"). EX1011, 2; EX1010, ¶27. Within the powder room, the powder is also oriented and "isostatically pressed into various shapes and sizes." *Id; see also* EX1015 1:1-30 (disclosing multiple known pressing methods). Due to the fact that rare earth elements (e.g., neodymium) were known for being easily oxidized, the powder was known to be flammable and would spontaneously combust. EX1003, 1:44-2:29; EX1011, 2; EX1010, ¶25. To prevent spontaneous combustion, factories utilized HVAC systems and began crushing and pressing the alloy in a temperature and humidity controlled room. EX1010, ¶¶26-27. Manufacturing a rare earth alloy magnet in this type of controlled environment was common knowledge and performed by all. *Id*.

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

Claims 1-12 should be accorded their "broadest reasonable construction" ("BRI") in light of the '565 patent's specification. 37 C.F.R. § 42.100(b); *see also In re Cuozzo Speed Technologies, LLC*, No. 2014-1301, slip. op. at 16, 19 (Fed. Cir. Feb. 4, 2014). In accordance with this standard of claim construction, Petitioner asserts that all terms should be given their ordinary and customary meaning. Under this standard, no terms or phrases require specific construction.[1]

Certain terms of the '565 patent were construed in the 855 Investigation, however, the PTAB is not bound by the ALJ's claim construction and can apply a broader standard. *In re Trans Texas Holding Corp*., 498 F.3d 1290, 1297-98, 1301 (Fed. Cir. 2007); *PPC Broadband, Inc. v. Corning Optical Commc'ns RF, LLC*, 815 F.3d 734, 742 (Fed. Cir. 2016) ("Under *Cuozzo*, claims are given their [BRI] consistent with the specification, not necessarily the correct construction under the framework laid out in *Phillips*.").

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[1] The '565 patent provides a definition for the term "dew point" as "the temperature at which a given parcel of air is saturated with water vapor." EX1001, 3:2-3. Petition applies this definition for purposes of this *inter partes* review.

VII. A PERSON OF ORDINARY SKILL IN THE ART

A. A Person of Ordinary Skill in the Art

A person of ordinary skill in the art ("POSA") is a hypothetical person who is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 420 (2007). A POSA in the field of the '565 patent would have (i) a bachelor's degree in materials science, metallurgical engineering, or physics and two to four years of work or research experience in the field of rare-earth magnets, or (ii) a master's degree in materials science, metallurgical engineering, or physics and one to two years of work or research experience in the field of rare-earth magnets. EX1010, ¶16.

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

Petitioner requests IPR of Claims 1-12 of the '565 patent on the grounds listed below. Per 37 C.F.R. § 42.6(d), copies of the references are filed herewith. In support, this Petition includes the declaration of a technical expert, Dr. John Ormerod. EX1010. Dr. Ormerod is an expert in the field of rare earth magnets and has offered a declaration from the perspective of a person of ordinary skill. EX1010, ¶17.

Ground	Reference(s)	Basis	Claims Challenged
1	Ren	35 U.S.C. § 102	1, 2, 6, 8
2	Ren	35 U.S.C. § 103	1, 2, 6, 8

3	Ren and Yamamoto	35 U.S.C. § 103	3
4	Ren and Kaneko	35 U.S.C. § 103	5
5	Ren, Yamamoto, and Kaneko	35 U.S.C. § 103	4
6	Ren and Kohara	35 U.S.C. § 103	9-12
7	Ren, Yamamoto, and Ota	35 U.S.C. § 103	7
8	Zhou and Young	35 U.S.C. § 103	1, 2, 6, 8-12
9	Zhou, Young, Yamamoto, and Kaneko	35 U.S.C. § 103	3-5
10	Zhou, Young, Yamamoto, and Ota	35 U.S.C. § 103	7

Moreover, as discussed below, prior art references in addition to the primary references listed above provide further background, further motivation to combine the teachings of these references and/or further support for why an ordinarily skilled artisan would have a reasonable expectation of success to arrive at the invention recited in the challenged claims.

IX. INVALIDITY ANALYSIS

A. Ground 1: Ren anticipates Claims 1, 2, 6, and 8

1. Disclosure of Ren

U.S. Patent No. 6,261,515 ("Ren", EX1003) issued to Guangzhi Ren, was filed March 1, 1999 and published on July 17, 2001, and qualifies as prior art under 35 U.S.C. § 102(e). Ren was not disclosed during prosecution.

Ren discloses "a method for producing rare earth-containing magnets that minimizes and controls the humidity level and oxygen content of the manufacturing environment during forming and molding." EX1003, 3:4-8. The method includes crushing/pulverizing a rare earth alloy into a magnetic powder (i.e. rare earth alloy powder) and then compressing the magnetic powder to form a green compact. *Id.* Figure 2, 8:35-50, 9:30-65; EX1010, ¶35. The compression process is "preferably" performed in a controlled environment where the "relative humidity is consistently maintained below approximately 40% and oxygen content below approximately 1% during the manufacturing step of forming and molding the magnetic powders into green compacts or magnetic bodies." EX1003, 3:54-57; 8:15-24. Further, Ren discloses in Tables 3-5, that compressing may be performed in an environment with the temperature range of 20°C to 30°C, and a humidity range of 40% to 90%. *Id.,* 5:1-65. Ren recognized that controlling the environmental relative humidity during manufacturing reduces oxidation and improves the strength of the magnet. *Id.* 2:1-30; EX1010, ¶35, 47.

2. Claim 1

Ren teaches each and every element of claim 1 as shown in the following chart. EX1010 ¶37-38.

Claim 1	**Prior Art**
A method of forming a green compact of a	*Ren* discloses "[t]he present invention is easily incorporated into existing methods for manufacturing rare earth-containing magnets, which typically include the steps . . . compressing the

<table>
<tr><th>Claim 1</th><th>Prior Art</th></tr>
<tr><td>rare earth alloy magnetic powder comprising the steps of:</td><td>magnetic powder to form a magnetic body or green compact ....” Id., 2:40-47; see also Abstract.</td></tr>
<tr><td>providing a rare earth alloy powder</td><td>Ren discloses “the steps of crushing or pulverizing a rare earth-containing alloy into a magnetic powder, forming and molding the magnetic powder, magnetically aligning the molded and formed magnetic powder, compressing the magnetic powder to form a magnetic body or green compact ….” Id., 2:40-47</td></tr>
<tr><td>providing a controlled environment having a temperature ranging from 5° C to 30° C and a relative humidity ranging from 40% to 65%; and</td><td>Ren discloses “[t]he following tables show the performance characteristics of rare earth-containing magnets manufactured using the invention, under different humidity and temperature conditions….”
TABLE 3
<table>
<tr><th>Relative Humidity
Temperature</th><th colspan="3">85%
30° C.</th><th colspan="3">55%
20° C.</th><th colspan="3">40%
30° C.</th></tr>
<tr><th>Properties & Characters</th><th>Br KGs</th><th>Hci KOe</th><th>(BH)m MGOe</th><th>Br KGs</th><th>Hci KOe</th><th>(BH)m MGOe</th><th>Br KGs</th><th>Hci KOe</th><th>(BH)m MGOe</th></tr>
<tr><td>Sample A/B/C</td><td>10.4</td><td>17.1</td><td>27.3</td><td>10.8</td><td>20.2</td><td>29.1</td><td>11.4</td><td>22.1</td><td>31.5</td></tr>
<tr><td>Sample D/E/F</td><td>10.5</td><td>18.2</td><td>27.8</td><td>11.0</td><td>20.8</td><td>30.0</td><td>11.5</td><td>22.4</td><td>31.6</td></tr>
<tr><td>Sample G/H/I</td><td>10.8</td><td>19.0</td><td>28.1</td><td>10.9</td><td>20.9</td><td>29.6</td><td>11.5</td><td>22.1</td><td>31.5</td></tr>
</table>
EX1003, 4:60-5:17; 5:18-65.

Ren discloses “[a]nother object of the invention is to provide a method for producing rare earth-containing magnets that minimizes and controls the humidity level and oxygen content of the manufacturing environment during forming and molding.” EX1003, 3:4-8.

Ren discloses “[p]referably, the relative humidity is consistently maintained below approximately 40% … during the manufacturing step of forming and molding the magnetic powders into green compacts or magnetic bodies.” EX1003, 3:54-57; 8:15-24.</td></tr>
<tr><td>pressing the rare earth alloy powder within</td><td>Ren discloses the “method reduces the ability of the rare earth element, namely neodymium, dysprosium, or a combination of neodymium and dysprosium, to react with oxygen-containing</td></tr>
</table>

Claim 1	Prior Art
the controlled environment.	sources prior to and during the molding, aligning in a magnetic field and compressing steps of the manufacturing process by isolating the magnetic powder and the formed magnet from oxygen-containing sources, wherein the humidity level and the oxygen content, is minimized and controlled." EX1003, 2:4-12; *see also* 2:40-47, 3:55-60, 4:60-67.

a) "a method of forming a green compact of a rare earth alloy magnetic powder"

To the extent the preamble is limiting, it is disclosed in Ren. Ren is directed toward a method for producing a green compact of rare earth alloy magnetic powder. EX1003, 2:40-47, Abstract. Magnetic powder is produced and transferred into molder bases and compressed to form a green compact. EX1003, Figure 2, 8:28-9:41; EX1010, ¶40. Thus, Ren discloses a method of forming a green compact of a rare earth alloy magnetic powder. EX1010, ¶42.

b) "providing a rare earth alloy powder"

Ren discloses "providing a rare earth alloy powder," because it teaches crushing or pulverizing an alloy to create a powder. EX1003, 8:28-32; 35-36; EX1010, ¶43.

c) "providing a controlled environment having a temperature ranging from 5°C to 30°C and a relative humidity ranging from 40% to 65%

Ren discloses a "controlled environment having a temperature ranging from 5°C to 30°C and a relative humidity ranging from 40% to 65%." EX1003, 2:4-13 (teaching controlling relative humidity); 3:4-7 (same), 3:55-60 (same); 4:60-67 (teaching controlling temperature and relative humidity); 8:15-24 (teaching controlling relative humidity); EX1010, ¶44.

Tables 3-5 of Ren shows several examples with controlled temperature range and controlled humidity that are within the ranges in Claim 1. *Id.*, ¶46. EX1003, 5:1-65; EX1010, ¶45.

TABLE 3

Relative Humidity Temperature	85% 30° C.			55% 20° C.			40% 30° C.		
Properties & Characters	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe
Sample A/B/C	10.4	17.1	27.3	10.8	20.2	29.1	11.4	22.1	31.5
Sample D/E/F	10.5	18.2	27.8	11.0	20.8	30.0	11.5	22.4	31.6
Sample G/H/I	10.8	19.0	28.1	10.9	20.9	29.6	11.5	22.1	31.5

TABLE 4

Relative Humidity Temperature	90% 30° C.			50% 20° C.			40% 30° C.		
Properties & Characters	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe
Sample J/K/L	10.6	23.0	27.1	10.7	25.3	28.1	11.1	26.8	29.8
Sample M/N/O	10.7	23.5	27.3	10.8	25.4	28.2	11.2	27.0	30.0
Sample P/Q/R	10.6	23.1	27.2	10.8	25.4	28.2	11.1	26.8	29.8

TABLE 5

Relative Humidity Temperature	85% 30° C.			55% 20° C.			40% 30° C.		
Properties & Characters	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe
Sample S/T/U	11.6	15.5	33.0	11.8	17.2	34.2	12.2	19.0	36.1
Sample V/W/X	11.7	15.8	33.1	11.9	17.4	34.5	12.1	18.8	36.0
Sample Y/Z/ALTHETA	11.6	15.8	33.0	11.8	17.25	34.3	12.1	18.9	36.0

When prior art discloses a particular example within a claimed range, the claimed range is anticipated. The relevant inquiry for anticipation rests on whether the claimed range is disclosed for a similar function, even if it merely overlaps with the claimed range. *See In re Haase*, 542 Fed. Appx. 962, 967 (Fed. Cir. 2013); *Titanium Metals Corp v. Banner,* 778 F.2d 775, 782 (Fed. Cir. 1985).

Here, the temperature and relative humidity in Ren not only overlap, but provide the same function as asserted in the ’565 patent: to reduce oxidation and improve magnetic properties. EX1010, ¶47 (Dr. Ormerod explaining the effect of controlling temperature and relative humidity as observed in Ren). Accordingly, Ren disclose this limitation.

d) “pressing the rare earth alloy powder within the controlled environment”

Ren discloses an environment wherein the temperature and humidity are controlled during manufacturing, including when pressing the magnetic powders into green compacts. EX1003, 2:1-12, 3:55-60, 4:60-67; EX1010, ¶48. These manufacturing steps take place in the controlled environments provided in Tables 3-5. EX1003, 4:60-5:55, 9:49-54; EX1010, ¶48.

Accordingly, Ren anticipates Claim 1. EX1010, ¶49.

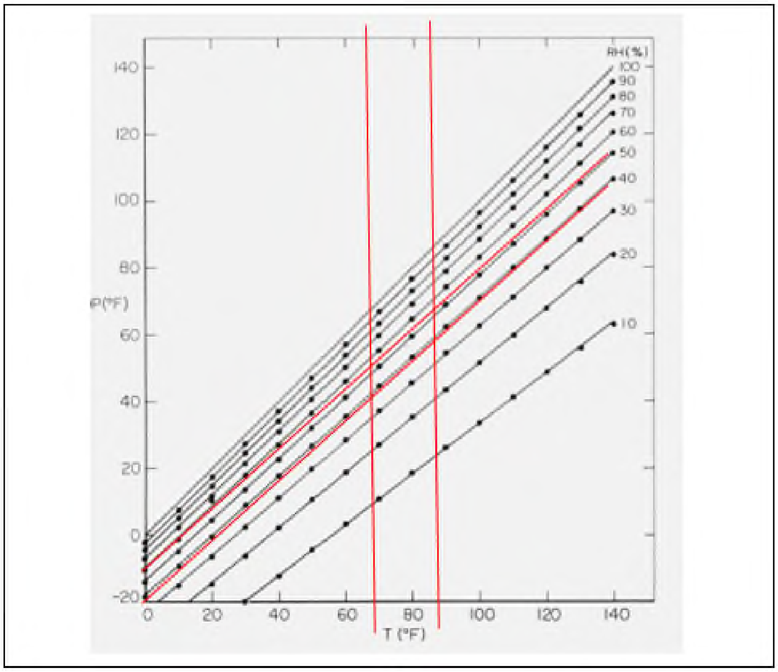
e) The transition phrase “comprising” allows for additional steps

The transition "comprising" is open-ended and allows for additional steps. *See Invitrogen Corp. v. Biocrest Mfg LP*, 327 F.3d 1364, 1368 (Fed. Cir. 2003). Thus, Claim 1 is open to further activity separate from the claimed temperature and humidity controls, thus would allow for additional steps such as controlling oxygen content by using inert gas. As Ren states, controlling oxygen content by using inert gas does not reduce moisture and hence is a separate step from controlling relative humidity. EX1003, 7:54-62; EX1010, ¶41.

3. Claim 2

Claim 2 recites the same limitations as claim 1, plus an additional limitation that recites that the controlled environment also has "a dew point of at least 6°C less than the temperature". For the remaining limitations that are identical, Ren teaches each limitation for the same reasons as discussed above for Claim 1. *See also* EX1010, ¶¶50-51.

Regarding the additional limitation of a "dew point of at least 6°C less than the temperature," Ren inherently discloses this claimed dew point range according to psychrometric charts, which show the temperature at which a given parcel of air is saturated with water vapor. EX1010, ¶52; *see also id.*, ¶54 (explaining the use of psychometric charts). As can be seen in the following psychometric chart, which is annotated with red lines to show the temperature and relative humidity conditions as taught by Ren,[2] the dew point under the controlled conditions in Ren will be "at least 6°C less than the temperature." EX1010, ¶54; EX1009, p.3. This can be determined by comparing the temperature (x-axis) and dew point (y-axis) for the relevant sloped line chosen by the relative humidity.



For example, taking the middle column shown in Table 3 of Ren, which has a temperature of 20°C (68°F) and a relative humidity of 55%, the dew point, as calculated from the values on the psychometric chart after converting to Celsius, is approximately 11°C (~51°F). EX1010, ¶55. In addition, taking the right most column in Table 5 of Ren, which has a temperature of 30°C (86°F) and a relative

[2] For example, Table 3 of Ren teaches a controlled environment with 55% relative humidity and 20°C (68°F) and another controlled environment with 40% relative humidity and 30°C (86°F).

humidity of 40%, the dew point is approximately 15°C (~59°F). *Id.* Both of these examples inherently have the claimed dew point. *See Titanium Metals,* 778 F. 2d at 782. As such, Claim 2 is anticipated by Ren.

4. Claim 6

Claim 6 is anticipated by Ren. EX1010, ¶56. Claim 6 depends from Claim 1 or 2. As recited above, Ren anticipates Claims 1 and 2. *See supra* Sections IX.A.2-3. Claim 6 further requires "the step of providing rare earth alloy powder containing oxygen at 6,000 ppm or less." Ren discloses the step of Claim 6.

Ren discloses rare-earth magnets that contain less than 6,000 ppm of oxygen. EX1003, 8:4-8, 4:65-67, 8:3-6; 8:25-34, 8:55-60; EX1010, ¶¶58-59. Ren provides the following explanation for the oxygen content:

> It has been shown that if the oxygen content of the rare earth-containing magnets is between 4000-6000 ppm, its maximum energy product is approximately 35 MGOe; if the oxygen content is below 4000 ppm, its max energy product increases to approximately 40 MGOe; and if the oxygen content is below 1800 ppm, its maximum energy product increases to approximately 50 MGOe.

EX1003, 4:5-12. Because the oxygen content of an alloy powder cannot be higher than the oxygen content of the magnet that is made by such powder, Ren discloses "providing rare earth alloy powder containing oxygen at 6,000 ppm or less" and anticipates Claim 6. EX1010, ¶59.

5. Claim 8

Claim 8 depends from Claim 1 or 2. Ren anticipates Claims 1 and 2. *See supra* Sections IX.A.2-3. Claim 8 requires the "step of providing a controlled environment, the controlled environment has a temperature of 15°C–25°C and a relative humidity of 40%–55%." Ren discloses the temperature and humidity ranges of Claim 8. With reference to Tables 3-5 shown below, Ren discloses exemplary environments within the claimed temperature (20°C) and humidity ranges (50% or 55%). *Id.*, 3:55-60, 4:60-67, 5:1-65; EX1010, ¶¶62-63. Thus, Ren anticipates Claim 8.

TABLE 3

Relative Humidity Temperature	85% 30° C.			55% 20° C.			40% 30° C.		
Properties & Characters	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe
Sample A/B/C	10.4	17.1	27.3	10.8	20.2	29.1	11.4	22.1	31.5
Sample D/E/F	10.5	18.2	27.8	11.0	20.8	30.0	11.5	22.4	31.6
Sample G/H/I	10.8	19.0	28.1	10.9	20.9	29.6	11.5	22.1	31.5

TABLE 4

Relative Humidity Temperature	90% 30° C.			50% 20° C.			40% 30° C.		
Properties & Characters	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe
Sample J/K/L	10.6	23.0	27.1	10.7	25.3	28.1	11.1	26.8	29.8
Sample M/N/O	10.7	23.5	27.3	10.8	25.4	28.2	11.2	27.0	30.0
Sample P/Q/R	10.6	23.1	27.2	10.8	25.4	28.2	11.1	26.8	29.8

TABLE 5

Relative Humidity Temperature	85% 30° C.			55% 20° C.			40% 30° C.		
Properties & Characters	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe
Sample S/T/U	11.6	15.5	33.0	11.8	17.2	34.2	12.2	19.0	36.1
Sample V/W/X	11.7	15.8	33.1	11.9	17.4	34.5	12.1	18.8	36.0
Sample Y/Z/ALTHETA	11.6	15.8	33.0	11.8	17.25	34.3	12.1	18.9	36.0

B. Ground 2: Claims 1, 2, 6, and 8 Would Have Been Obvious In View of Ren Alone

To the extent Ren does not anticipate Claims 1, 2, 6, and 8 of the ’565 patent, Ren alone would have rendered these claims obvious.

1. Claim 1

As previously stated, Ren discloses the temperature and humidity ranges of Claim 1. *See supra* Section **Error! Reference source not found.**; EX1010, ¶¶75-81. Moreover, Claim 1 is also rendered obvious by Ren. The temperature and relative humidity in Ren, as discussed for Ground 1, overlap with the claimed range. *In re Kenneth*, 409 F.3d 1339, 1341 (Fed. Cir. 2005) (finding obviousness where the prior art disclosed ranges that overlapped the claimed ranges).

Furthermore, a POSA would have been motivated to control the temperature and relative humidity to be within the claimed range according to the teachings of Ren. In particular, Ren teaches a manufacturing process that isolates the magnetic powder from sources of oxidation, “wherein the humidity level and the oxygen content, is minimized and controlled.” *Id.* at 2:4-13. The method in Ren “is based on the fact that environmental humidity oxidizes with neodymium in a rare earth-containing magnet.” *Id.* at 2:13-14; EX1010, ¶77. As Dr. Ormerod explains, a POSA would recognize the effect of controlling the temperature and relative humidity as shown in Ren. EX1010, ¶80. Table 3 of Ren showed that the (BH)max values of the samples exposed to 40% relative humidity and 30°C conditions were

14% higher (i.e., better) than samples exposed to 85% relative humidity and 30°C, thus showing that a lower relative humidity of 40% was better. *Id.* A comparison of samples exposed to 85% relative humidity and 30°C temperature to samples exposed to 55% relative humidity and 20°C temperature showed the later samples to have better (BH)max. *Id.* Thus, a POSA would have been motivated to control the temperature and relative humidity within the range that was shown to be good in Ren, which happens to fall within the claimed range of the '565 patent. *Id.*

A POSA would have also looked to Ren's teaching, which states it is "a cost-effective method for manufacturing rare earth containing magnets that consistently reduces and/or controls the ability of oxygen-containing sources [e.g., moisture] to react with the magnetic powder during the manufacture of the rare earth containing magnet." EX1003, 1:60-64. A POSA would have known that "oxidation of neodymium in the magnet is seriously destructive to the properties of rare earth-containing magnets," and that "oxygen content of neodymium-iron-boron rare earth magnets is the key factor affecting the magnet's properties." EX1003, 1:44-50; EX1010, ¶82. Ren teaches that "[a]s a result of reducing the humidity level and oxygen content throughout the forming and molding step . . . oxidation of the magnetic powders and green compacts is minimized, and the magnetic properties of the rare earth magnet are substantially improved." EX1003, 2:54-60; EX1010, ¶82; EX1017, 5 ("[T]he oxidation of the magnetic particles was especially severe at a high environmental temperature and high relative humidity."). Thus, Ren provides general motivation to improve the magnet properties by controlling relative humidity. As a result, POSA would also be motivated to control temperature because the susceptibility to degradation by moisture is naturally affected by temperature due to chemical reaction kinetics. EX1010, ¶164.

Further, to the extent Patent Owner asserts that the potential omission of inert gas from Claim 1 makes it non-obvious,[3] the Board has previously found that even if an industry "gold standard" is known, the mere departure from it—even if such modification results in inferiority—does not make it unobvious. *Gnosis S.P.A. v. S. Ala. Med. Sci. Found.,* IPR2013-00116, Paper 68 (Final Written Decision) at 11-12 (rejecting an argument that a POSA would not have looked to other options when a "gold standard" was established, stating that "it does not follow that a [POSA] would have avoided alternatives simply because a standard is known to be suitable and to work well") (P.T.A.B. June 20, 2014); *In re Mouttet,* 686 F.3d 1322, 1334 (Fed. Cir. 2012) ("[J]ust because better alternatives exist in the prior art does not mean that an inferior combination is inapt for obviousness purposes.").

[3] Such an argument would be without merit as it would not be commensurate with the claim scope, because the transition phrase "comprising" allows for additional steps. *In re Peterson,* 315 F.3d 1325, 1331 (Fed. Cir. 2003).

Given that there were only two options, at the very least, both (i.e., with or without inert gas) would have been obvious or obvious to try. *In re Kubin*, 561 F.3d 1351, 1359 (Fed. Cir. 2009). Compressing magnetic powders without inert gas was known, thus such an option would be evident to a POSA. EX1018, 3:6-9, 3:33-36; EX1008, 3:3-6; EX1010, ¶81. Furthermore, as Ren recognizes, the use of inert gas "does not reduce or eliminate H_2O from the surrounding environmental humidity" (EX1003, 7:54-58), thus a POSA would still have been motivated to control relative humidity and temperature. EX1010, ¶¶81, 164.

a) Reasonable Expectation of Success

A successful embodiment of the temperature and humidity ranges of Claim 1 is disclosed in Tables 3-5 of Ren. EX1003, 4:60-5:55; Table 3-5 EX1010, ¶83. Ren's tables and disclosure regarding humidity would have provided a POSA with a reasonable expectation of success, particular where Ren teaches that "consistently maintaining the relative humidity below approximately 40%" reduces oxygen and produces superior rare earth magnets. EX1003, 3:61-4:2; EX1010, ¶83. A POSA would have understood that Tables 3-5 taught that adjusting temperature and relative humidity would affect the (BH)max values, and thus the overall strength of the magnet. EX1010, ¶¶80, 83. A POSA would have followed the teachings of Ren, which cover well-known methods and compositions, to successfully reduce oxidation in a rare earth alloy magnet and improve the strength of the magnet. EX1010, ¶83. As such, Claim 1 is invalidated as obvious.

2. Claim 2

As previously stated, the limitations of Claim 2 are similar to those of Claim 1. Ren discloses the temperature and relative humidity ranges of Claim 2, including the additional limitation that the controlled environment also has "a dew point of at least 6°C less than the temperature". *See supra* Section **Error! Reference source not found.**; EX1010, ¶84. As such, the obviousness analysis of Claim 1 over Ren applies to Claim 2.

Furthermore, as discussed above in Ground 1, the additional limitation of a "dew point of at least 6°C less than the temperature" is inherently disclosed in Ren according to psychrometric charts which graphically display the physical and thermodynamic properties of air at a constant pressure. EX1009, 119; EX1010, ¶¶85-89. The claimed dew point is nothing more than a latent property of an otherwise obvious method, which cannot rebut obviousness. *In re Baxter Travenol Labs*., 952 F.2d 388, 392 (Fed. Cir. 1991) ("Mere recognition of latent properties in the prior art does not render nonobvious an otherwise known invention."); *Santarus, Inc. v. Par Pharm., Inc.*, 694 F.3d 1344, 1354 (Fed. Cir. 2012). As such, Claim 2 is obvious.

3. Claim 6

Claim 6 depends from Claims 1 or 2 and requires "the step of providing a rare earth alloy powder containing oxygen at 6,000 ppm or less." In addition to being anticipated, Claim 6 is rendered obvious by Ren's teaching of less than 6,000 ppm of oxygen (*see, e.g.,* EX1003, 8:4-8, 4:65-67), which is the same as the claimed range. *See In re Haase*, 542 Fed. Appx. at 967; *In re Kenneth*, 409 F.3d at 1341.

Furthermore, Ren teaches that the maximum energy product generally increases as the amount of oxygen is reduced, which provides motivation to have as little oxygen as possible to reduce oxidation and improve the magnetic properties of the rare earth magnet. EX1003, 4:3-12; EX1010, ¶¶90-91. Thus, Ren provides the motivation known throughout the rare earth magnet industry: to reduce oxidation and obtain maximum energy product (i.e., (BH)max). EX1003, 2:1-25, 2:55-60, 4:3-26; EX1010, ¶92; EX1017, 3 ("Oxidation changed the composition and microstructure of the magnet, leading to a drastic degradation of the properties of the magnet."); *see also* EX1013, 5:18-21 ("It has been revealed that the corrosion resistance is primarily related with this R-rich boundary phase. The 'R' in the R-rich phase is very apt to be oxidized by oxygen and/or moisture in the ambient atmosphere."), 5:22-40, 8:4-8. A POSA would have been encouraged by improved magnetic properties disclosed in Ren and would have followed its teachings to produce a rare earth magnet. EX1010, ¶92; EX1003, Tables 3-5. Therefore, Claim 6 is obvious over Ren.

4. Claim 8

Claim 8 depends from Claims 1 or 2 and requires "the controlled environment has a temperature of 15°C–25°C and a relative humidity of 40%–55%." As recited above in Ground 1, Ren anticipates Claim 8. Claim 8 is also rendered obvious by Ren's teaching because a POSA would have been motivated to have the water vapor in the air controlled to reduce oxidation and improve the magnetic properties of the rare earth magnet. EX1010, ¶¶93-96.

TABLE 3

Relative Humidity Temperature	85% 30° C.			55% 20° C.			40% 30° C.		
Properties & Characters	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe
Sample A/B/C	10.4	17.1	27.3	10.8	20.2	29.1	11.4	22.1	31.5
Sample D/E/F	10.5	18.2	27.8	11.0	20.8	30.0	11.5	22.4	31.6
Sample G/H/I	10.8	19.0	28.1	10.9	20.9	29.6	11.5	22.1	31.5

TABLE 4

Relative Humidity Temperature	90% 30° C.			50% 20° C.			40% 30° C.		
Properties & Characters	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe
Sample J/K/L	10.6	23.0	27.1	10.7	25.3	28.1	11.1	26.8	29.8
Sample M/N/O	10.7	23.5	27.3	10.8	25.4	28.2	11.2	27.0	30.0
Sample P/Q/R	10.6	23.1	27.2	10.8	25.4	28.2	11.1	26.8	29.8

TABLE 5

Relative Humidity Temperature	85% 30° C.			55% 20° C.			40% 30° C.		
Properties & Characters	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe	Br KGs	Hci KOe	(BH)m MGOe
Sample S/T/U	11.6	15.5	33.0	11.8	17.2	34.2	12.2	19.0	36.1
Sample V/W/X	11.7	15.8	33.1	11.9	17.4	34.5	12.1	18.8	36.0
Sample Y/Z/ALTHETA	11.6	15.8	33.0	11.8	17.25	34.3	12.1	18.9	36.0

Ren overlaps the temperature range of 15°C-25° C and a relative humidity of 40%-50% as disclosed in claim 8 and thus renders it obvious. *Id.*, ¶94. In Tables 3-5, Ren discloses exemplary environments within the claimed temperature and relative humidity ranges. EX1003, 4:60-67, 5:1-65; EX1010, ¶95.

A POSA would have known that a rare earth magnet could be compressed using a temperature range of 20°C and a humidity range of 50-55%, thus providing a successful embodiment within the scope of Claim 8, and that controlling relative humidity and temperature will improve the magnetic properties of the rare earth magnet and reduce the chance of combustion. EX1003, 3:55-60, 4:60-67, 5:1-65; EX1010, ¶96.

C. Ground 3: Claim 3 Would Have Been Obvious Over Ren In View of Yamamoto

1. Disclosure of Yamamoto

U.S. Patent No. 5,383,978 ("Yamamoto," EX1004) was issued January 24, 1995 and therefore qualifies as prior art under 35 U.S.C. § 102(b). Yamamoto generally discloses a process for creating a permanent magnet with excellent magnetic properties using known strip casting techniques. EX1004, Abstract, 1:1-12. This method includes melting a rare earth metal iron alloy to obtain a molten alloy and solidifying the molten alloy uniformly at a cooling rate of 10-1000 °C/sec. EX1004, 2:30-40, Claim 1.

2. Claim 3

Claim 3 depends from Claims 1 or 2. Claims 1 and 2 are anticipated by and/or obvious over Ren. *See supra* Sections IX.A.2-A.3, IX.B.1-B.2. Claim 3 requires the additional limitations of "solidifying a molten alloy at a rate from 10^2°C./sec to 10^4°C./sec" and "pulverizing the solidified alloy to form the provided rare earth alloy." The additional claim limitations recited by Claim 3 are obvious in view of Yamamoto. EX1010, ¶99.

Yamamoto is directed to creating alloy ingots for "[a] permanent magnet and anisotropic powders." EX1004, Abstract, 1:8-14, 2:18-23. Yamamoto teaches solidifying a molten alloy uniformly at a cooling rate of 10-1000 °C/sec. EX1004 2:32-37; EX1010, ¶101. Yamamoto specifically states "the rare earth metal-iron alloy in the molten state is allowed to be uniformly solidified under the cooling conditions of the cooling rate of 10° to 1000°C./sec., preferably 100° to 1000°C./sec." EX1004, 4:19-25. Thus, Yamamoto teaches "solidifying a molten alloy at a rate from 10^2°C./sec to 10^4°C./sec" as required by Claim 3.

Yamamoto further teaches the common step of pulverizing the ingot to form a rare earth alloy powder. EX1010, ¶102. Specifically, Yamamoto discloses "[t]he alloy ingots A and B of the present invention may be formed into permanent magnets . . . by the conventional process steps of pulverization, mixing, comminution, compression in the magnetic field and sintering." EX1004, 5:14-19; *see also id.*, 5:46-52. Thus, Yamamoto teaches "pulverizing the solidified alloy to form the provided rare earth alloy" as required by Claim 3.

It would have been obvious to use such well-known methods for the known purpose to yield the known results as predicted and described in Yamamoto. EX1010, ¶103. Furthermore, a POSA would have been motivated to combine the teachings of Ren with Yamamoto and create the rare earth alloy of Ren utilizing the cooling rate as taught by Yamamoto in order to produce an alloy with a preferred crystalline structure that affords excellent magnetic properties. EX1004 2:6-17; EX1010, ¶103. Given Yamamoto's disclosure it would have been well within the capability of a POSA to apply Yamamoto's cooling rate and then pulverizing the resulting alloy. EX1010, ¶103. Thus, Claim 3 is obvious over Ren and Yamamoto. *Id.*

D. Ground 4: Claim 5 Would Have Been Obvious Over Ren In View of Kaneko

1. Disclosure of Kaneko

U.S. Patent No. 5,666,635 ("Kaneko," EX1005) was issued on September 9, 1997 and is prior art under §102(b).

Kaneko generally discloses "a fabrication method for high performance R-Fe-B [rare earth alloy] permanent magnets with excellent press packing characteristics…" EX1005, Abstract. Kaneko is concerned with "oxidation [that] occurs during processing" and thus reduces the magnetic properties. *Id.*, 2:25-27.

Kaneko suggests adding a lubricant to the powder prior to compressing to "greatly improve" the "fabrication efficiency." *Id.*, 3:34-41.

In addition, Kaneko teaches that the "cast alloy is a thin plate with a thickness of 0.03 mm~10 mm," *Id.*, 3:56-58, and that the cross-sectional structure of the R-Fe-B alloy "obtained by the strip casting method of the present invention has main phase $R_2T_{14}B$ crystals less than one tenth the size of those in ingots obtained by conventional casting," *Id.*, 4:4-8; EX1010, ¶106. An example provided discloses "fine crystals with a short axis dimension of 0.1 μm-50 μm and a long axis dimension of 5 μm-200 μm are obtained, and the R-rich phase which surrounds these main phase crystals will also be finely distributed." EX1005, 4:8-12. Because oxidation can occur prior to compressing, these characteristics are important for the original alloy that is used to make the powders. *Id.*, 3:61-66; EX1010, ¶106.

2. Claim 5

Claim 5 depends from either Claim 1 or 2. Claims 1 and 2 are anticipated by and/or obvious over Ren. Claim 5 requires "adding a lubricant to the rare earth alloy powder prior to said pressing step."

Kaneko teaches a POSA how to produce "a fabrication method for high performance R-Fe-B [rare earth alloy] permanent magnets with excellent press packing characteristics." EX1005, Abstract. Kaneko teaches "fine powder surfaces will be uniformly covered by lubricant after fine grinding, which improves both the grinding efficiency and the press packing characteristics." 5:35-38; *see also id.*, 5:41-65 (describing the content of the lubricant).

A POSA would have known these and other well-known advantages of using a lubricant. EX1010, ¶¶109-10. Accordingly, it would have been obvious to a POSA to add a lubricant to achieve the known and predicted results. EX1010, ¶111. Furthermore, a POSA would be motivated to combine the teachings of Kaneko to achieve the purported "excellent packing characteristics" to achieve good results. EX1005, Abstract. A POSA would have a reasonable expectation of success, because adding a lubricant is a well-known process with known results and a simple step to add. EX1005, 2:55-57; EX1010, ¶111. As such, Claim 5 is obvious over Ren in view of Kaneko.

E. Ground 5: Claim 4 Is Obvious Over Ren in View of Yamamoto and Kaneko

Claim 4 depends from Claim 3. Claim 3 is obvious over Ren in view of Yamamoto. *See supra* Section IX.C.2 The limitations recited by Claim 4 are obvious in view of Kaneko, which teaches each element of claim 4 as shown in the following claim chart. EX1010, ¶112.

Claim 4	Prior Art
The method of claim 3, wherein the solidified alloy is a rare earth alloy with a thickness between 0.03 mm and 10 mm,	Kaneko discloses an alloy plate "with a thickness of 0.03 mm~10 . . . ." EX1005, 3:56-58.
and includes $R_2T_{14}B$ crystal grains, where R is a rare earth element, T is	Kaneko discloses "[t]he cross-sectional structure of the R-Fe-B alloy of a

Claim 4	Prior Art
either iron or a compound of iron and a transition metal element in which iron is partially replaced with the metal element, and B is boron, and R-rich phases,	particular composition obtained by the strip casting method of the present invention has main phase $R_2Fe_{14}B$ crystals less than one tenth the size of those in ingots obtained by conventional casting. . . . and the R-rich phase . . . ." *Id.*, 4:4-10.
the sizes of the $R_2T_{14}B$ crystal grains being from 0.1 µm through 100 µm in a minor axis direction and from 5 µm through 500 µm in a major axis direction, the R-rich phases dispersed around a boundary of the $R_2T_{14}B$ crystal grains.	Kaneko discloses "[f]or example, fine crystals with a short axis dimension of 0.1 µm – 50 µm and a long axis dimension of 5 µm – 200 µm are obtained, and the R-rich phase which surrounds these main phase crystals will also be finely distributed, and even if there is an area of local segregation, it is of a size less than 20 µm." *Id.* at 4:4-15.

1. "wherein the solidified alloy is a rare earth alloy with a thickness between 0.03 mm and 10 mm"

Kaneko discloses a rare earth alloy made by strip casting (*id.,* 4:4-8), whose thickness is between 0.03 mm and 10 mm (*id.*, 3:54-4:3). Kaneko explains that "[f]or a thickness less than 0.03 mm, the quenching effect is large resulting in crystallites smaller than 3 µm and as these crystallites are easily oxidized when powdered, a deterioration in the magnetic characteristics results." EX1005, 3:62-66. Kaneko also explains that "[f]or a thickness exceeding 10 mm, the cooling speed is slow and α-Fe will easily crystallize, causing the crystallite size to become large, and a segregation of the Nd-rich phase to occur, causing a deterioration in the magnetic characteristics." *Id.*, 3:66-4:3. Thus, Kaneko provides a POSA with motivation to stay within 0.03-10 mm. EX1010, ¶¶114, 116. In addition, the '565 patent admits in the Description of the Related Art that the claimed thickness was known. EX1001, 1:43-45. Given Kaneko's disclosure and the common knowledge of a successfully formed 0.03-10 mm rare earth alloy, it would have been well within the capability of a POSA to successfully implement the claimed thickness for a strip casted rare earth alloy. EX1010, ¶115.

2. "includes $R_2T_{14}B$ crystal grains, where R is a rare earth element, T is either iron or a compound of iron and a transition metal element in which iron is partially replaced with the metal element, and B is boron, and R-rich phases"

Kaneko discloses that the cross-sectional structure of the R-Fe-B alloy has "main phase $R_2F_{14}B$ crystals" and R-rich phase (EX1005, 4:4-10), where R is a rare earth metal, Fe (i.e., T) is iron, and B is boron. EX1010, ¶117. In addition, the '565 patent admits in the Description of the Related Art that the claimed limitation was well known. EX1001, 1:50-55 ("Accordingly, when prepared by a strip casting method, for example, a rapidly solidified alloy has a structure including a combination of $R_2T_{14}B$ crystal phases and R-rich phases."); EX1010, ¶118.

It would have been obvious to have the claimed structure, which are nothing more than common and well-known structures of prior art rare earth alloys. *Id.*, ¶119. A POSA would also have had a reasonable expectation of success based on Kaneko's teaching, which creates a resultant magnet that has exceptional press packing characteristics and a high degree of orientation of the magnetization direction of each crystallite. EX1005, 2:65-3:6; EX1010, ¶119.

3. **"the sizes of the $R_2T_{14}B$ crystal grains being from 0.1 µm through 100 µm in a minor axis direction and from 5 µm through 500 µm in a major axis direction, the R-rich phases dispersed around a boundary of the $R_2T_{14}B$ crystal grains."**

Kaneko discloses the claimed characteristics of $R_2F_{14}B$ crystals, as shown in the following passage:

> The cross-sectional structure of the R-Fe-B alloy of a particular composition obtained by the strip casting method of the present invention has main phase $R_2Fe_{14}B$ crystals less than one tenth the size of those in ingots obtained by conventional casting. For example, fine *crystals with a short axis dimension of 0.1 µm~50 µm and a long axis dimension of 5 µm~200 µm are obtained, and the R-rich phase which surrounds these main phase crystals* will also be finely distributed, and even if there is an area of local segregation, it is of a size less than 20 µm.

Id., 4:4-15 (emphasis added).

Thus, Kaneko discloses $R_2T_{14}B$ crystals that have sizes from 0.1-50 µm in a minor axis direction (i.e. short axis) and 5-200 µm in a major axis direction (i.e. long axis). *Id.*; EX1010, ¶121. Furthermore, the R-rich phases are finely dispersed and surrounds the main phrase crystal, i.e., are dispersed around the boundary of the $R_2T_{14}B$ crystal grains. *Id.* In addition, Patentee admits the claimed limitation was well known. EX1001 at 1:53-55 ("Normally, the sizes of each of the $R_2T_{14}B$ crystal phases are from 0.1 um through 100 um in the minor axis direction and from 5 um through 500 um in the major axis direction."); EX1010, ¶122.

It would have been obvious to have the well-known properties of rare earth alloys using well-known methods. *Id.*, ¶ 123. It would have been obvious to combine the teachings of Kaneko with Ren and Yamamoto, which all are directed to the same subject matter of manufacturing rare earth permanent magnets, and create a resultant alloy that has exceptional press packing characteristics and a high degree of orientation of the magnetization direction of each crystallite. EX1005, 2:63-3:6; EX1010, ¶123. As such, Claim 4 would have been obvious.

F. Ground 6: Claims 9-12 Are Obvious Over Ren In View of Kohara

1. Disclosure of Kohara

U.S. Patent No. 6,299,832 ("Kohara," EX1007) was filed on December 27, 1999 and issued on October 9, 2001 and is therefore prior art under §102(e).

Kohara discloses "a process for supplying a rare earth metal-based alloy powder to a cavity in a mold, for example, in order to subject the rare earth metal-based powder to pressing for producing a rare earth metal-based magnet." EX1007, 1:5-20. Figure 1 of Kohara shows die set 2 with a die hole 2b which form one or more cavities 4. *Id.,* 8:15-22; EX1010, ¶126. Figure 1 also shows "upper punch 5 is inserted into the cavity 4 to compress the alloy powder m by cooperation with the lower punch 3, thereby forming a green compact of the alloy powder." EX1007, 8:25-28. The green compact is removed from the die hole in order to transport it to a sintering furnace. *Id.*, 11:35-40; EX1010, ¶126. By using the apparatus as disclosed in Figure 1, "the produced sintered magnets had no cracking and no chipping, and their weights were uniform." EX1007, 11:41-42.

2. Claim 9

Claim 9 depends from Claim 1 or 2. Claims 1 and 2 are anticipated and/or obvious in view of Ren. The additional claim limitations recited by Claims 9, which are nothing more than common features of known pressing machines, are obvious in view of Kohara which teach each feature as shown in the chart below.

Claim 9	**Prior Art**
The method of claim 1 or 2, further comprising the steps of: providing a die pressing machine comprising: a die with a die hole for forming at least a portion of a cavity, and first and second punches for compacting the powder inside the hole;	*Kohara* discloses "Fig. 1 is a perspective view of the entire arrangement of a pressing system equipped with rare earth metal-based alloy powder supplying apparatus according to the present invention." EX1007, 8:11-14. *Kohara* discloses "[i]n FIG. 1, reference character 1 designates a base plate. A die 2a is fitted in a die set 2 disposed adjacent to the base plate 1, and has a die hole 2b . . . A lower punch 3 is disposed, so that they can be fitted into the die hole 2b from below, whereby a cavity 4 of any volume is defined by an inner peripheral source of die hole 2b and an upper end face of the lower punch 3." *Id.*, 8:15-22.
filling the cavity with the powder with at least an upper end of the second punch inserted into the die hole;	*Kohara* discloses "[i]n FIG. 1, reference character 5 designates an upper punch. An alloy powder m is supplied into the cavity 4 by a feeder box 10 . . . ." *Id.*, 8:23-25.

compacting the powder in the die between the first and second punches, thereby forming a green compact of the powder;	*Kohara* discloses "[t]hen the upper punch 5 is interested into the cavity 4 to compress the alloy powder m by cooperation with the lower punch 3, thereby forming a green compact of the alloy powder." *Id.*, 8:26-29.
and ejecting the compact out of the die hole.	*Kohara* discloses "[i]n the pressing, a rare earth metal-based alloy green compact of . . . . was produced . . . The green compact produced in the above manner was transported to a sintering furnace" *Id.*, 11:32-37.

a) "providing a die pressing machine comprising a die with a hole for forming at least a portion of a cavity"

Kohara discloses a die pressing machine as shown in Figure 1 of Kohara below. *Id.*, 8:11-14; EX1010, ¶129.

FIG. 1

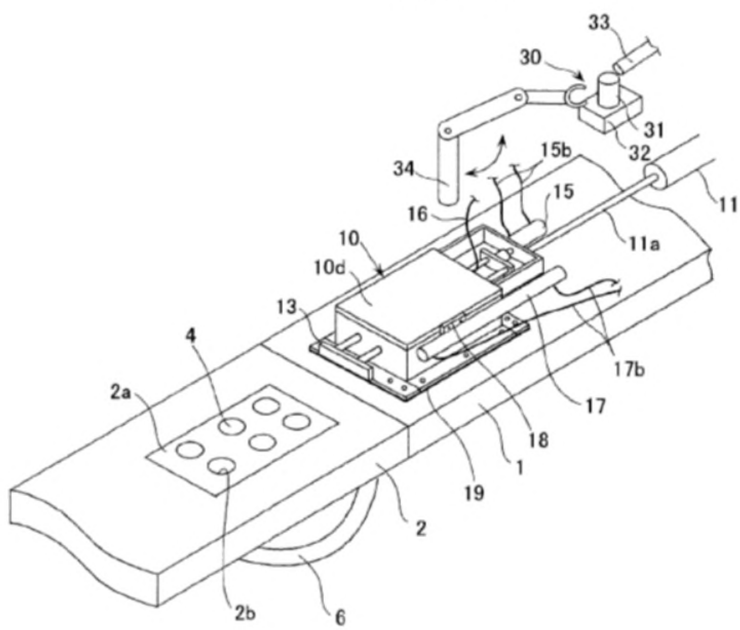


Figure 1 shows die set (2) with a die hole (2b) which form one or more cavities (4). *Id.*, 8:15-35; EX1010, ¶130.

b) “first and second punches for compacting the powder inside the hole”

Kohara states “the upper punch 5 is inserted into the cavity 4 to compress the alloy powder m by cooperation with the lower punch 3, thereby forming a green compact of the alloy powder.” EX1007, 8:26-29. The upper punch (5) and lower punch (3) are first and second punches, while the cavity (4) is the hole where the powder is compacted. EX1010, ¶131.

c) “filing the cavity with the powder with at least an upper end of the second punch inserted into the die hole”

Furthermore, Kohara discloses “[a]n alloy powder m is supplied into the cavity 4 by a feeder box 10.” EX1007, 8:23-25. Given the structural design of Kohara’s press machine, it would have been obvious to have the upper end of the lower (second) punch 3 inserted into the cavity 4 when filling it with powder. EX1010, ¶132.

d) “compacting the powder in the die between the first and second punches thereby forming a green compact of the powder”

Kohara states “the upper punch (5) is inserted into the cavity (4) to compress the alloy powder m by cooperation with the lower punch (3), thereby forming a green compact of the alloy powder.” EX1007, 8:26-29; EX1010, ¶133.

e) “ejecting the compact out of the die hole.”

In Kohara, the pressing forms a green compact and the green compact is removed from the die hole in order to be transported to a sintering furnace. EX1007, 11:35-37; EX1010, ¶134.

f) It would have been obvious to use the pressing machine in Kohara

It would have been obvious to a POSA to use the press in Kohara, which use well-known components in known ways and is generally interchangeable with other pressing methods. EX1010, ¶135, n.1; EX1016, 63 (discussing die-pressing and other pressing methods). Kohara also provides motivation to use its press by stating that the press produced a sintered magnet free of cracks and chips and displays a uniform weight. EX1007, 11:41-42; EX1010, ¶135; *see also* EX1007, 1:39-47 (discussing the benefits of the disclosed press). Thus, Claim 9 would have been obvious.

3. Claim 10

Claim 10 depends from Claim 9. Claim 9 is obvious over Ren in view of Kohara as discussed above. Claim 10 requires "the step of sintering the compact." The additional claim limitations recited by Claims 10 are also obvious in view of Kohara and Ren, which disclose sintering the green compact. Specifically, Kohara recites "[i]n the pressing, a rare earth metal-based alloy green compact . . . was produced . . . . The green compact produced in the above manner was transported to a sintering finance." EX1007, 11:32-37. Ren also discloses sintering the green compact. EX1003, 9:55-57. It would have been obvious to sinter the green compact as disclosed in Kohara and Ren to form a rare earth magnet, because it is a well-known and common step and would yield predictable results. EX1010, ¶137. A POSA would also have had a reasonable expectation of success because sintering is a well-known step. EX1010, ¶137. Thus, Claim 10 is obvious. *Id.*

4. Claim 11

Claim 11 depends from Claim 10. Claim 10 is obvious over Ren in view of Kohara as discussed above. Claim 11 further requires that "said pressing step is performed in a first chamber, and said sintering step is performed in a second chamber having a temperature within 5° C. of the first chamber."

a) "said pressing step is performed in a first chamber"

Kohara teaches the compacting (i.e. pressing) step on a pressing system apparatus. Kohara teaches "[i]n the pressing, a rare earth metal-based alloy green compact . . . was produced." EX1007, 11:32-35. A POSA would recognize that a chamber under the BRI standard is an area/room/enclosure and does not require or preclude additional enclosures within such chamber. EX1010, ¶139. Thus, Kohara teaches pressing is performed in a first chamber. *Id.*

b) "said sintering step is performed in a second chamber having a temperature within 5° C of the first chamber"

As Dr. Ormerod explains, Kohara meets this limitation as well. *Id.*, ¶¶140-41. Kohara teaches "the green compact produced in the above manner was transported to a sintering furnace." EX1007, 11:30-40. Sintering is a separate process from compressing. EX1010, ¶140. Sintering is by a furnace and compressing is by a press, thus different equipment are used. *Id.* Accordingly, the sintering step is performed in a second chamber, i.e., a different area/room/enclosure from that of the press, such as separate rooms. *Id.*

It would have been obvious to have the first chamber and second chamber at relatively similar temperature conditions, i.e., to "hav[e] a temperature within 5°C" of each other as required by Claim 11. EX1010, ¶141. For example, Ren teaches the manufacturing process, which includes pressing and sintering (EX1003, 2:40-47), to occur at a specific temperature which happens to be near room temperature (EX1003, 4:60-64, Tables 3-5, 10:2). EX1010, ¶141. Thus, Ren teaches conditions where "said sintering step is performed in a second chamber having a temperature within 5° C of the first chamber" as required by Claim 11. *Id.* Furthermore, it would have been a matter of choice to place the first chamber and second chamber next to each other without any special insulation between the chambers (*e.g.,* EX1011, 14), which would result in the two chambers or rooms having a similar temperature. EX1010, ¶141. Ren's teaching also provides a reasonable expectation of success, because it shows the successful manufacture of magnets under the claimed temperature conditions. *Id.*

In addition, a POSA would also want to keep the temperatures of the second chamber within 5° C of the first chamber so as not to risk condensation, which would cause oxidation and loss of magnetic properties. *Id.* Thus, a POSA would have been motivated to have the claimed temperature condition.

5. Claim 12

Claim 12 depends from Claim 11. Claim 11 is obvious over Ren in view of Kohara as discussed above. Claim 12 requires "said pressing step is performed in a first chamber large enough for a human being to work therein."

Manufacturing of permanent magnets, including pressing, are generally performed in rooms. EX1010, ¶¶27, 143; EX1011, 2 (disclosing manufacturing in controlled rooms), 14 (showing a room for pressing). A POSA would have known that the press in Kohara and Ren require human operation and thus a chamber (e.g., a room) large enough to include that human being. EX1010, ¶143. As such, Claim 12 would have been obvious. *Id.*, ¶144.

G. Ground 7: Claim 7 Would Have Been Obvious Over Ren in view of Yamamoto and Ota

1. Disclosure of Ota

Japanese Patent No. JP 63-033505 ("Ota," EX1006) was published on February 13, 1988 and is prior art under §102(b).

Ota generally discloses a method for manufacturing alloy powder for rare-earth magnets. EX1006, 21. Ota teaches using a jet mill to pulverize a rare earth metal alloy into powder. *Id.*, 21-23. The jet mill is used with supersonic inert gas for "pulverizing an ingot and then causing a spontaneous disintegration by absorption of H_2 is injected into a pulverizing chamber for pulverization by a supersonic inert gas flow containing 50 to 60,000 ppm of O_2 to finely pulverize into a fine powder." *Id.*, 23-24.

2. Claim 7

Claim 7 depends from Claim 3. As stated in Ground 3, Claim 3 is obvious in view of Ren and Yamamoto. *See supra* Part IX.C.2. Claim 7 further requires "the step of forming an oxide layer on the surface of particles of the rare earth alloy powder by performing said pulverizing step in a jet mill with a controlled concentration of an oxidizing gas."

Ota discloses pulverizing an alloy using a jet mill. EX1006, 26 ("The coarsely pulverized powder was then jet pulverized with the jet mill shown in FIG. 1 . . . ."), FIG. 1. Ota discloses the following:

> [A] method for manufacturing raw material powder for permanent magnet material wherein a coarsely pulverized powder of average grain size of 10μm to 500 μm obtained by pulverizing an ingot and then causing a spontaneous disintegration by absorption of H_2 is injected into a *pulverizing chamber* for pulverization by a supersonic inert *gas flow containing 50 to 60,000 ppm of O_2 to finely pulverize into a fine powder* having an average grain size of 1.5 to 5 μm.

EX1006, 23 (emphasis added). Ota further discloses forming "a stable oxide film . . . on [the] surface" of the powder. *Id.*, 22. Thus, Ota discloses the claimed limitation. EX1010, ¶150.

A jet mill is a conventional method for pulverizing an alloy. *Id.*, ¶151; *see also* EX1003, 8:38; EX1005, 1:49-50. It would have been obvious to use such a well-known method to achieve known results. EX1010, ¶151. Furthermore, a POSA would have been motivated to pulverizing an alloy in a jet mill with a controlled concentration of an oxidizing gas as taught by Ota to obtain a finely pulverized powder with an ideal grain size. EX1006, 22-24, 26; EX1010, ¶151. It would have been well within the capability of a POSA to successfully implement Ota's pulverization method. *Id*. Thus, Claim 7 would have been obvious.

H. Ground 8: Claims 1, 2, 6, 8-12 Would Have Been Obvious Over Zhou and Young

1. Disclosure of Zhou

Zhou et al., *Effect of Environmental Retention Time of NdFeB Magnetic Particles on Structure and Properties of Sintered Magnet*, Journal of Magnetic Materials Devices, Vol. 24, Issue 2 (April 1993) ("Zhou," EX1017) was published in April 1993 and is prior art under 35 U.S.C. § 102(b).

Zhou observed that the properties of rare earth permanent magnets were affected by temperature and relative humidity at which the alloy powders were kept, stating the following:

> When the magnetic particles were placed in the atmosphere at 20°C and 50% RH for 48 hours, the magnetic properties of the sintered magnet were not significantly degraded. When the magnetic particles were placed in the atmosphere at 30°C and 100% RH for 48 hours, the sintered magnet lost permanent magnetic properties, with significant changes in its phase structure and microstructures.

EX1017, Abstract. These observations were made via placing milled powder in different temperature and relative humidity conditions and then measure the properties of permanent magnets made from such powder. *Id*., 1; EX1010, ¶154.

When the temperature and relative humidity were kept to 20°C and 50%, respectively, there no notable effect on the magnet properties. EX1017, 2. On the other hand, when the temperature and relatively humidity were kept at higher levels of 30°C and 100%, respectively, there were serious effects on the magnet properties which Zhou observed to be caused by oxidation. *Id*., 2-3.

2. Disclosure of Young

U.S. Patent No. 5,093,076 ("Young," EX1008) was issued on March 3, 1992 and is prior art under 35 U.S.C. § 102(b).

Young is directed to pressing rare earth permanent magnets, where a rare earth element containing alloy powder is pressed in ambient temperature and open air. EX1008, Title, Abstract; EX1010, ¶158. Young discloses that "powder material of an above-described composition in an amount based on the dimensions of the desired workpiece, is first compacted to a green compact at ambient temperature and in air." EX1008, 3:4-10. Young also discloses the structural components of the press. EX1008, 2:39-68, FIGS. 1a-1b.

3. Claim 1

Zhou and Young combined teaching each limitation of Claim 1 as shown in the chart below. EX1010, ¶160.

Claim 1	**Prior Art**
A method of forming a green compact of a rare earth alloy magnetic powder comprising the steps of:	*Zhou* teaches pressing magnetic particles, i.e., compressing a rare earth alloy powder. EX1017, 1; EX1010, ¶160. *Young* discloses "powder material of an above-described composition in an amount based on the dimensions of the desired workpiece, is first compacted to a green compact at ambient temperature and in air." EX1008, 3:4-10.
providing a rare earth alloy powder	*Zhou* teaches a powdering process and using powder metallurgy techniques. EX1017, 1; EX1010, ¶160. *Young* discloses "[t]he starting material for the practice of our invention is a melt-spun ribbon particle or powder composition composed so as to ultimately form a magnet body consisting essentially of the tetragonal phase $RE_2TM_{14}B$ and a minor portion of a grain boundary phase(s) of higher rare earth element content." EX1008, 2:19-23.
providing a controlled environment having a temperature ranging from 5°C to 30°C and a relative	*Zhou* discloses "[w]hen the magnetic particles consisting of $Nd_{16.5}Fe_{76}B_{7.5}$ were placed in the atmosphere at 20°C and 50% RH for 48 hours, the

Claim 1	Prior Art
humidity ranging from 40% to 65%; and	magnetic properties of the sintered magnet were not significantly degraded." EX1017, 4. *Zhou* discloses "the effect of retention time of magnetic particles placed in the atmosphere at 30°C and 100% RH on the magnetic properties and demagnetization curve of the sintered magnet. . . . In such an atmosphere, the retention time of the magnetic particles has a serious effect on the properties of the sintered magnet." EX1017, 2; *see also* Abstract. *Zhou* discloses "[d]uring the process of manufacturing a sintered NdFeB permanent magnet with optimal magnetic properties, its cast ingot needs to be crushed to become particles sized 3 μm to 7 μm. Due to the small particle size, the particles have a very large specific area and have significant chemical reactivity. If exposed in an open environment, these particles will adsorb various gases in the environment and react chemically with them . . . ." EX1017, 4. *Young* discloses "[i]ndeed, an advantage of our invention is that both compaction steps can be carried out on open-to-the-air presses." EX1008, 4:45-48. *Young* discloses "powder material of an above-described composition in an amount based on the dimensions of the desired workpiece, is first compacted to a green compact at ambient temperature and in air. This pressing can be called cold pressing." EX1008, 3:4-10.
pressing the rare earth alloy powder within the controlled environment.	*Zhou* teaches pressing magnetic particles, i.e., compressing a rare earth alloy powder. EX1017, 1.

Claim 1	Prior Art
	Young discloses "powder material of an above-described composition in an amount based on the dimensions of the desired workpiece, is first compacted to a green compact at ambient temperature and in air. This pressing can be called cold pressing." EX1008, 3:4-10. *Young* discloses "[i]n attempting to work with such readily oxidizable rare-earth element-containing materials, it has been necessary to provide a suitable protective atmosphere in which the rare earth and other constituents are not oxidized and the permanent magnetic properties of the materials are not degraded." EX1008, 1:45-52.

Zhou teaches that temperature and relative humidity of the environment in which the alloy powder is placed affects the properties of the resulting magnet. EX1017, 1. In particularly Zhou found that conditions of high moisture and high temperature degraded the properties of the permanent magnet. EX1017, 1-2; EX1010, ¶161. Zhou also found that when the environment (i.e., temperature and relative humidity) surrounding the powder was controlled to 20°C and 50% relative humidity, the permanent magnet was not degraded. EX1017, 1-2; EX1010, ¶162.

Young teaches that the pressing step is carried out at ambient temperature and open air. EX1008, 1:59, 3:4-10, 4:45-48; EX1010, ¶163. The advantages of being able to press the alloy powder in open air was recognized by Young and generally were well-known. EX1008, 1:63-2:3, 4:45-47; EX1006, 22-23; EX1010, ¶163.

In view of Zhou's teaching of controlling the temperature and relative humidity, which apply to the environment of the pressing step (EX1017, 2), a POSA would have been motivated to conduct pressing in a controlled environment of 20°C and 50% relative humidity to avoid degradation of the magnet properties. EX1010, ¶164. Further, in view of Young's teaching of pressing in ambient temperature and air (EX1008, 3:4-10), as well as a POSA's awareness that pressing in open air was generally known and convenient (*see, e.g.,* EX1006, 22-23; EX1010, ¶¶26-27, 164), a POSA would have been motivated to conduct the pressing step in open air. These prior art teachings would have been relevant to the pressing step because of the well-known degrading effect of moisture, which also would naturally be affected by temperature due to the chemical reaction kinetics. *See, e.g.,* EX1017, 1-2; EX1008, 1:45-46; EX1010, ¶164.

Given that the temperature and relative humidity conditions disclosed in Zhou are within the range of temperature and relative humidity that would be expected for ambient temperature and open air, including rooms with air conditioning (*see* EX1010, ¶27; EX1003, 2:20-40; EX1011, 2; EX1017, 5), a POSA would have had a reasonable expectation of success in using the temperature and relative humidity disclosed in Zhou. EX1010, ¶165. Indeed, the claimed temperature and relative humidity ranges are nothing more than comfortable indoor conditions. *See, e.g.,* EX1025, Abstract (finding that a relative humidity between 40-60% minimized adverse health effects); EX1026, 4 ("[T]emperature variations between 21.5 and 24.75°C did not appear to significantly affect work speed . . . ."). Accordingly, Claim 1 would have been obvious over Zhou and Young. *Id.*

4. Claim 2

As previously stated, the limitations of Claim 2 are similar to those of Claim 1. Zhou discloses the temperature and relative humidity ranges of Claim 2, including the additional limitation that the controlled environment has "a dew point of at least 6°C less than the temperature," which is nothing more than an inherent property of the temperature and relative humidity. EX1010, ¶¶166-67.

A "dew point of at least 6°C less than the temperature" will naturally and inherently occur when the temperature is 20°C and 50% relative humidity as disclosed in Zhou, which fall within the claimed range. EX1010, ¶168. Using the same psychrometric charts discussed above and the same simple calculations (*see supra* Sections IX.A.3), a POSA would know the "dew point [is] at least 6°C less than the temperature" for the conditions disclosed in Zhou and recited in Claim 4. *See* EX1009, 3; EX1010, ¶168. Given the dew point is part of the conditions in Zhou and Young, a POSA would have had a reasonable expectation of success for the same reasons for Claim 1. As such, Claim 2 would have been obvious.

5. Claim 6

Claim 6 depends from Claims 1 or 2 and requires "the step of providing rare earth alloy powder containing oxygen at 6,000 ppm or less." Claims 1 and 2 are obvious over Zhou and Young as discussed above. Zhou also renders obvious the limitation of Claim 6.

Zhou teaches the original oxygen content of the ingot is 0.2% (2,000 ppm) to 0.4% (4,000 ppm) (EX1010, ¶171), and that the oxygen content is doubled by powdering, pressing, and sintering. Zhou states the following:

> [T]he *oxygen content (mass percent) in the steel ingot* for NdFeB permanent magnet smelted with a vacuum induction furnace *was generally 0.2% to 0.4%, and the oxygen content in the magnet roughly doubled after powdering, pressing and sintering*. In other words, almost 50% to 60% of the oxygen in the magnet was introduced during powdering, pressing and sintering.

EX1017, 3 (emphasis added). An ingot oxygen content of 3,000 ppm, i.e., the midpoint of Zhou's range, would be approximately 6,000 ppm in the sintered magnet after doubling. EX1010, ¶171. The oxygen content of the powder before pressing and sintering would be further lower, thus Zhou teaches a rare earth alloy powder that would have an oxygen content of 6,000 ppm or less. *Id.*

Furthermore, a POSA would have been motivated to provide a rare earth alloy powder with a low oxygen content, because Zhou teaches that the alloy powder subject to 30°C and 100% relative humidity had higher oxygen content and degraded magnet properties. EX1017, 3; EX1010, ¶172. A POSA would also have had a reasonable expectation of success, because a POSA would have known that Zhou teaches preparing magnets with overlapping ranges of oxygen content. EX1017, 3; EX1010, ¶173; *see also* EX1003, 4:3-10 (disclosing an oxygen content of 6,000 ppm or below). A POSA would also have expected that reducing the amount of oxygen content according to Zhou would reduce degradation of the properties. EX1010, ¶173. Accordingly, Claim 6 would have been obvious over Zhou and Young.

6. Claim 8

Claim 8 depends from claims 1 or 2 and requires "the controlled environment has a temperature of 15° C.–25° C. and a relative humidity of 40%–55%." Zhou teaches that a controlled environment of 20°C and 50% relative humidity did not have the negative effect on the magnet properties compared to 30°C and 100% relative humidity. EX1017, 1-2; EX1010, ¶175.

For the same reasons as discussed for Claim 1 (*see supra* Section IX.H.3), a POSA would have been motivated to control the environment to be 20°C and 50% relative humidity as taught by Zhou to achieve good magnet properties. EX1017, 1-2; EX1010, ¶176. A POSA would have also had a reasonable expectation of success in using such conditions that were taught to be good for a rare earth element containing alloy powder. *Id.* Accordingly, Claim 8 would have been obvious over Zhou and Young.

7. Claim 9

Claim 9 depends from Claims 1 or 2. Claims 1 and 2 are obvious as discussed above. Claim 9 further requires "providing a die pressing machine" with certain components and steps of using such die pressing machine. Young teaches a die pressing machine and using such machine that meets the limitations of Claim 9 as shown in the chart below. EX1010, ¶177.

Claim 9	Prior Art
The method of claim 1 or 2, further comprising the steps of: providing a die pressing machine comprising: a die with a die hole for forming at least a portion of a cavity, and first and second punches for compacting the powder inside the hole;	*Young* discloses a die pressing machine "with the *lower punch 16* in its down position and the *upper punch 18* in its upper position and the lubricant film applied to the wall of the die cavity (FIG. 1b), the *cavity 14* is now ready to receive the powdered, rapidly solidified iron-neodymium-boron type material." EX1008, 6:43-50 (emphasis added). *Young* discloses "[a]s soon as the particulate material 52 has been loaded into the die, the upper punch is lowered to close the die cavity. *The upper and lower punches are then loaded to consolidate the powder into the green compact 34*." *Id.*, 6:54-58 (emphasis added).
filling the cavity with the powder with at least an upper end of the second punch inserted into the die hole;	*Young* discloses "[a]s soon as the particulate material 52 has been loaded into the die, the upper punch is lowered to close the die cavity. The upper and lower punches are then loaded to consolidate the powder into the green compact 34." *Id.*, 6:54-58.
compacting the powder in the die between the first and second	*Young* discloses "[a]s soon as the particulate material 52 has been loaded into the die, the

punches, thereby forming a green compact of the powder;	upper punch is lowered to close the die cavity. The upper and lower punches are then loaded to consolidate the powder into the green compact 34." *Id.*, 6:54-58.
and ejecting the compact out of the die hole.	*Young* discloses "[a]s soon as the compaction has been completed, the upper punch is raised out of the way to its upper position as depicted in FIG. 1a, the lower punch is raised to ejected the compact from the die, the compact is removed." *Id.*, 6:64-68.

Young discloses a typical die pressing machine that can be used for forming green compacts from powders of rare earth element containing alloys. EX1010, ¶178. Figure 1b of Young is reproduced below and shows a die pressing machine with several components, including a die (die member 12) with a die hole (die cavity 14) for forming at least a portion of a cavity, and first and second punches (lower punch 16 and upper punch 18) for compacting the powder inside the hole. EX1008, 4:64-5:8; EX1010, ¶178.

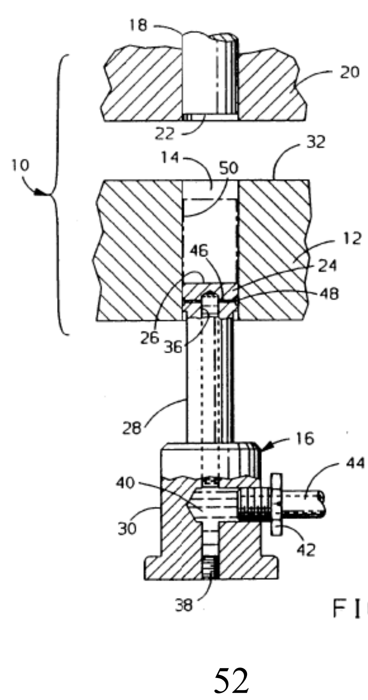


FIG. 1b

Young also discloses "[a]s soon as the particulate material 52 has been loaded into the die, the upper punch is lowered to close the die cavity. The upper and lower punches are then loaded to consolidate the powder into the green compact 34." EX1008, 6:54-58. Thus, Young discloses filling the cavity with the powder (particulate material) with at least an upper end of the second punch (lower punch) inserted into the die hole, and then compacting the powder in the die between the first and second punches (upper and lower punches), thereby forming a green compact of the powder. EX1010, ¶178. Young discloses "[a]s soon as the compaction has been completed, the upper punch is raised out of the way to its upper position as depicted in FIG. 1a, the lower punch is raised to eject the compact from the die, and the compact is removed." EX1008, 6:64-68. Thus, Young also discloses ejecting the compact out of the die hole. EX1010, ¶178.

A POSA would have had a reasonable expectation of success of using a well-known and typical die pressing machine as taught in Young at room temperature and open air, which would include the temperature and relative humidity conditions taught by Zhou. *Id.* Accordingly, Claim 9 would have been obvious over Zhou and Young.

8. Claim 10

Claim 10 depends from Claim 9. Claim 9 is obvious as discussed above. Claim 10 further requires "the step of sintering the compact."

Zhou is directed to a sintered magnet where the pressed green compact is sintered. EX1017, 1-2. Thus, Zhou teaches the step of sintering the compact. EX1010, ¶181. Young also refers to the sintering process as part of the known permanent magnet preparation processes. EX1008, 1:53-59; EX1010, ¶182.

Furthermore, the claimed steps are all standard steps of preparing sintered magnets as Zhou and Young themselves show. EX1017, 1-2; EX1008, 6:54-68; EX1010, ¶183. Moreover, the die pressing machine of Young is a typical one that can be used for forming green compacts that would later be sintered. EX1010, ¶184. A POSA would have had a reasonable success of "sintering the compact" according to the teachings of Young and Zhou, which require nothing more than common and well-known processes. Accordingly, Claim 10 would have been obvious over Zhou and Young.

9. Claim 11

Claim 11 depends from Claim 10. Claim 10 is obvious as discussed above. Claim 11 requires "said pressing step is performed in a first chamber, and said sintering step is performed in a second chamber having a temperature within 5° C. of the first chamber."

a) "pressing step is performed in a first chamber"

As discussed above, the BRI of the term "chamber" is any space, (e.g., an area or room or enclosure) where pressing and/or sintering is performed. *See supra*

Section IX.F.4. Young discloses that "[t]he practices of our invention are suitably carried out in an open air press of the type having a die(s) with a die wall defining a die cavity of suitable cross-sectional configuration." EX1008, 2:39-42. Zhou also discloses pressing. EX1017, 1. Accordingly, Young and Zhou teach the "pressing step is performed in a first chamber." EX1010, ¶186.

b) "said sintering step is performed in a second chamber having a temperature within 5° C. of the first chamber"

Zhou discloses a sintering step after pressing. EX1017, 1-2. Young also references sintering after pressing. EX1008, 1:53-59. The same tools are not used in pressing (a press) and sintering (an oven), thus, it would have been a matter of choice and convenience to place them in separate chambers (i.e., different rooms or space). EX1010, ¶187; EX1011, Figure 1; EX1008, 3:38-43, 7:52-57.

As discussed above, a POSA would have been motivated to conduct the pressing step at around 20°C according to Zhou, which is about room temperature. EX1017, 1. Further, it would have been typical to have the sintering equipment to be placed in a room under room temperature. EX1010, ¶188. A temperature difference less than 5°C between the first and second chambers would also have been obvious, because a POSA would have avoided temperature conditions that would cause condensation on the surface of the green compact. *Id.* Also, it would have been a matter of choice to place the first and second chambers next to each other without any special insulation (e.g., EX1011, 14), which would result in the two chambers having a similar temperature. EX1010, ¶188. A POSA would have also had a reasonable expectation of success with the pressing equipment and sintering equipment in separate rooms but with comparable temperature, i.e., both rooms kept at about room temperature of 20°C, because they were common and normal conditions. *Id.*, ¶189.

Accordingly, Claim 11 would have been obvious over Zhou and Young. *Id.*

10. Claim 12

Claim 12 depends from Claim 11 and requires "said pressing step is performed in a first chamber large enough for a human being to work therein." Young teaches that pressing is carried out in open air. EX1008, 2:39-42. The temperature and relative humidity conditions of Zhou can also be carried out in open air, because they are room temperature and relative humidity. EX1017, 1; EX1010, ¶191. Accordingly, it would have been obvious to have the pressing step performed in the first chamber and be "large enough for a human being to work therein." As such, Claim 12 would have been obvious over Zhou and Young.

I. Ground 9: Claims 3-5 Would Have Been Obvious Over Zhou, Young, Yamamoto, and Kaneko

1. Claim 3

Claim 3 depends from Claims 1 or 2. Claim 3 is obvious over Zhou and Young as discussed in Ground 8. Claim 3 further requires "solidifying a molten alloy at a rate from 10^{2}° C./sec to 10^{4}° C./sec, and pulverizing the solidified alloy to form the provided rare earth alloy powder."

Yamamoto discloses "production of an alloy ingot for permanent magnet by the strip casting method." EX1004, 3:5-7. Yamamoto further teaches that "[t]he alloy ingot is produced by solidifying the molten alloy uniformly at a cooling rate of 10° to 1000° C./sec. at a sub-cooling degree of 10° to 500° C. A permanent magnet and anisotropic powders are produced from the alloy ingot." *Id.*, Abstract; *see also id.*, 2:30-40, 4:20-25; EX1001, ¶¶101, 193. It was known that strip casting produced a cooling rate on the order of 10^{4} K/s. EX1014, 6; EX1010, ¶193.

Yamamoto teaches the conventional and very common step of pulverizing an alloy to form a rare earth alloy powder. EX1004, 5:14-20; EX1010, ¶¶102, 194. Yamamoto states "[t]he alloy ingots A and B of the present invention may be formed into permanent magnets . . . by the conventional process steps of pulverization, mixing, comminution, compression in the magnetic field and sintering." EX1004, 5:14-20; *see also id.*, 8:45-52.

Both steps were well known and a POSA would have found it obvious to use such strip casting methods with the disclosed cooling rate of Yamamoto with the teachings of Young and Zhou. EX1010, ¶195. Kaneko further shows that strip casting was a well-known and commonly used process and a POSA would have had a reasonable expectation of success in using such techniques. EX1005, 4:4-10; *see* *also* EX1004, 3:5-7; EX1014, 6; EX1010, ¶195. Furthermore, to the extent Patent Owner asserts that there were methods other than strip casting, a POSA would have known that strip casting was interchangeable with other commonly used and well-known methods, such as ingot casting and melt-spinning. EX1010, ¶195. Further, Yamamoto teaches that a permanent magnet produced according to its teaching would have excellent magnetic properties. EX1004, 2:6-17, 2:36. As Kaneko teaches, a POSA would have known that strip casting provides a fine grain and homogenous composition (i.e., good dispersion and a uniform structure). EX1005, 3:34-40; EX1010, ¶195. Accordingly, Claim 3 would have been obvious.

2. Claim 4

Claim 4 depends from Claim 3. Claim 3 is obvious as discussed above. Claim 4 requires additional limitations relating to the thickness of the alloy and crystal grain properties. As shown in the chart below, Kaneko teaches each limitation of Claim 4:

Claim 4	Prior Art
The method of claim 3, wherein the solidified alloy is a rare earth alloy with a thickness between 0.03 mm and 10 mm,	Kaneko discloses "The plate thickness is limited to 0.03 mm to 10 mm because of the following." EX1005, 3:
and includes $R_2T_{14}B$ crystal grains, where R is a rare earth element, T is either iron or a compound of iron and a transition metal element in which iron is partially replaced with the metal element, and B is boron, and R-rich phases,	Kaneko discloses "[t]he cross-sectional structure of the R-Fe-B alloy of a particular composition obtained by the strip casting method of the present invention has main phase $R_2Fe_{14}B$ crystals less than one tenth the size of those in ingots obtained by

Claim 4	Prior Art
	conventional casting. … and the R-rich phase ….” *Id.*, 4:4-10.
the sizes of the $R_2T_{14}B$ crystal grains being from 0.1 µm through 100 µm in a minor axis direction and from 5 µm through 500 µm in a major axis direction, the R-rich phases dispersed around a boundary of the $R_2T_{14}B$ crystal grains.	Kaneko discloses "For example, fine crystals with a short axis dimension of 0.1 µm – 50 µm and a long axis dimension of 5 µm – 200 µm are obtained, and the R-rich phase which surrounds these main phase crystals will also be finely distributed, and even if there is an area of local segregation, it is of a size less than 20 µm." *Id.* at 4:4-15.

As shown in the chart above and discussed *supra* at Section IX.E, Kaneko teaches each limitation of Claim 4 and it would have been obvious to use the well-known techniques and structures taught by Kaneko with equally well-known techniques disclosed in Zhou, Young, and Yamamoto. EX1010, ¶¶114-123, 196-197. Further, a POSA would have been motivated to use strip casting for the known benefits of achieving excellent magnetic properties (EX1004, 2:6-17, 2:36) and good dispersion and a uniform structure (EX1005, 3:34-40). EX1010, ¶¶195, 197. Accordingly, Claim 4 would have been obvious.

3. Claim 5

Claim 5 depends from Claim 1 or 2. Claims 1 and 2 are obvious over Zhou and Young as discussed above. Claim 5 further requires "adding a lubricant to the rare earth alloy powder prior to said pressing step."

Kaneko teaches adding a lubricant to the powder prior to compressing to "greatly improve" the "fabrication efficiency." EX1005, 3:34-41; EX1010, ¶109-

111, 199. A POSA would have also known that adding a lubricant provides several benefits, such as facilitating mold release, avoiding delamination or cracks, and improving rotation and alignment. EX1024, 2:38-50, 3:41-55; EX1010, ¶199. A POSA would have had a reasonable expectation of using a lubricant, because lubricants were commonly used and well-known. EX1010, ¶199. Thus, Claim 5 would have been obvious.

Furthermore, a POSA would have been motivated to use the common classes of lubricants as taught by Kaneko (EX1005, 5:41-44, 5:59-61; *see also* EX1024, 2:51-67), which can be removed by heating and vacuuming as taught by Kaneko (EX1005, 7:52-58). EX1010, ¶200. Again, given the known benefits of lubricants, to the extent there was a desire to remove such lubricant after its purpose has been fulfilled, it would have been obvious to use a lubricant and remove such lubricant by heat and vacuum. *Id.*

Young also teaches using a lubricant. EX1008, Abstract. Young's statement that the Teflon powder lubricant is used on the die wall would not have detracted a POSA from using a lubricant in other known ways for the known benefits that lubricants provided. EX1010, ¶200. Furthermore, even if Patent Owner were to allege that the use of lubricant according to Kaneko is an inferior one, that does not preclude a finding of obviousness where, as here, there was a clear reasoning to add a lubricant. *In re Mouttet,* 686 F.3d at 1334.

Accordingly, Claim 5 would have been obvious.

J. Ground 10: Claim 7 would Have Been Obvious Over Zhou, Young, Yamamoto, and Ota

Claim 7 depends from Claim 3, which in turn depends from Claims 1 or 2. Claims 1 and 2 are obvious over Zhou and Young. *See supra* Sections IX.H.3-4.

Claim 3 further requires "solidifying a molten alloy at a rate from 10^{2}° C./sec to 10^{4}° C./sec, and pulverizing the solidified alloy to form the provided rare earth alloy powder." Claim 3 is obvious over Zhou, Young and Yamamoto, because Yamamoto teaches that "[t]he alloy ingot is produced by solidifying the molten alloy uniformly at a cooling rate of 10° to 1000° C./sec. at a sub-cooling degree of 10° to 500° C. A permanent magnet and anisotropic powders are produced from the alloy ingot." EX1004, Abstract; *see also id.*, 2:30-40, 4:20-25; EX1001, ¶¶101, 193; EX1014, 6. Yamamoto also teaches pulverizing an alloy to form a rare earth alloy powder. EX1004, 5:14-20, 8:45-52; EX1010, ¶¶102, 194. Both steps in Claim 3 were well known and a POSA would have found it obvious to use such strip casting methods with the disclosed cooling rate of Yamamoto with the teachings of Young and Zhou. EX1010, ¶195.

Claim 7 further requires "the step of forming an oxide layer on the surface of particles of the rare earth alloy powder by performing said pulverizing step in a jet mill with a controlled concentration of an oxidizing gas." As discussed above for Ground 7, Ota teaches "[t]he coarsely pulverized powder was then jet pulverized with the jet mill shown in FIG. 1 under the following conditions: … O2 content: 5000 ppm." EX1006, FIG. 1, 26; *see supra* Section IX.G.2; EX1010, ¶202. The jet mill introduces a "[s]upersonic inert gas containing 50 to 60,000 ppm of O2 and flowing through gas introduction tube 5 injects the coarsely pulverized powder 1 into pulverizing chamber 6…" EX1006, 23. The powder is then finely pulverized by "collision between the raw material powder and the supersonic inert gas." *Id*. Using this method, the O2 "provide[s] [a] fine powder where a stable oxide film is formed on its surface…." *Id*., 22.

It would have been obvious to use a jet milling, which is a conventional method used to finely pulverize rare earth iron boron magnet alloys. *See* EX1006, 22 (discussing dry pulverization using a jet mill and comparing with wet pulverization); EX1003, 8:38 (using a jet mill to "pulvige magnetic powder); EX1005, 1:49-50 ("grinding with a jet mill using an inert gas"); EX1010, ¶151, 203. A POSA would have been motivated to add the step of pulverizing in a jet mill with a controlled concentration of an oxidizing gas as taught by Ota. EX1006, 23-24, 26; EX1010, ¶203. The results include a finely pulverized powder with an ideal grain size which is more stable, "thus preventing combustion when removing from the mill or when press-compacting in atmosphere." EX1006, 22. Thus, Claim 7 would have been obvious.

K. Objective Indicia of Non-Obviousness

As the challenged claims are anticipated, objective indicia have no relevance since they are only relevant to the obviousness inquiry. *Bristol-Myers Squibb Co. v. Ben Venue Labs.*, 246 F.3d 1368, 1380 (Fed. Cir. 2001). Although objective indicia of non-obviousness must be taken into account in the obviousness calculus, they do not necessarily control the obviousness conclusion. *Newell Cos., Inc. v. Kenney Mfg. Co.*, 864 F.2d 757, 768 (Fed. Cir. 1988).

A strong case of obviousness, such as the instant one, cannot be overcome by objective evidence of non-obviousness. *See Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1372 (Fed. Cir. 2008); *Hoffmann-La Roche Inc. v. Apotex Inc.*, 748 F.3d 1326, 1334 (Fed. Cir. 2014). To the extent Hitachi does in fact assert an objective indicia in this proceeding, detailed consideration of Hitachi's evidence should not be undertaken until Petitioner has had an opportunity to respond to Hitachi's position. *Amneal Pharms., LLC v. Supernus Pharms., Inc.*, IPR2013-00368 [Paper 8, pp. 12-13].

X. CONCLUSION

For the foregoing reasons, *inter partes* review of Claims 1-12 of the ’565 patent is requested.

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CERTIFICATION OF WORD COUNT

Pursuant to 37 C.F.R. §§ 42.24, the undersigned certifies that the argument section of this Petition (Sections I–II, V–X) has 13,559 words, less than 14,000 words, according to the word count tool in Microsoft Word™.

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CERTIFICATION OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e), 42.8(b)(4) and 42.105, the undersigned certifies that on the 24th day of April 2017, a complete copy of the foregoing Petitioner's Petition for *Inter Partes* Review of U.S. Patent No. 6,461,565, Power of Attorney, Exhibit List, and all supporting exhibits were served via UPS® to the Patent Owner by serving the correspondence address of record for the '565 patent:

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