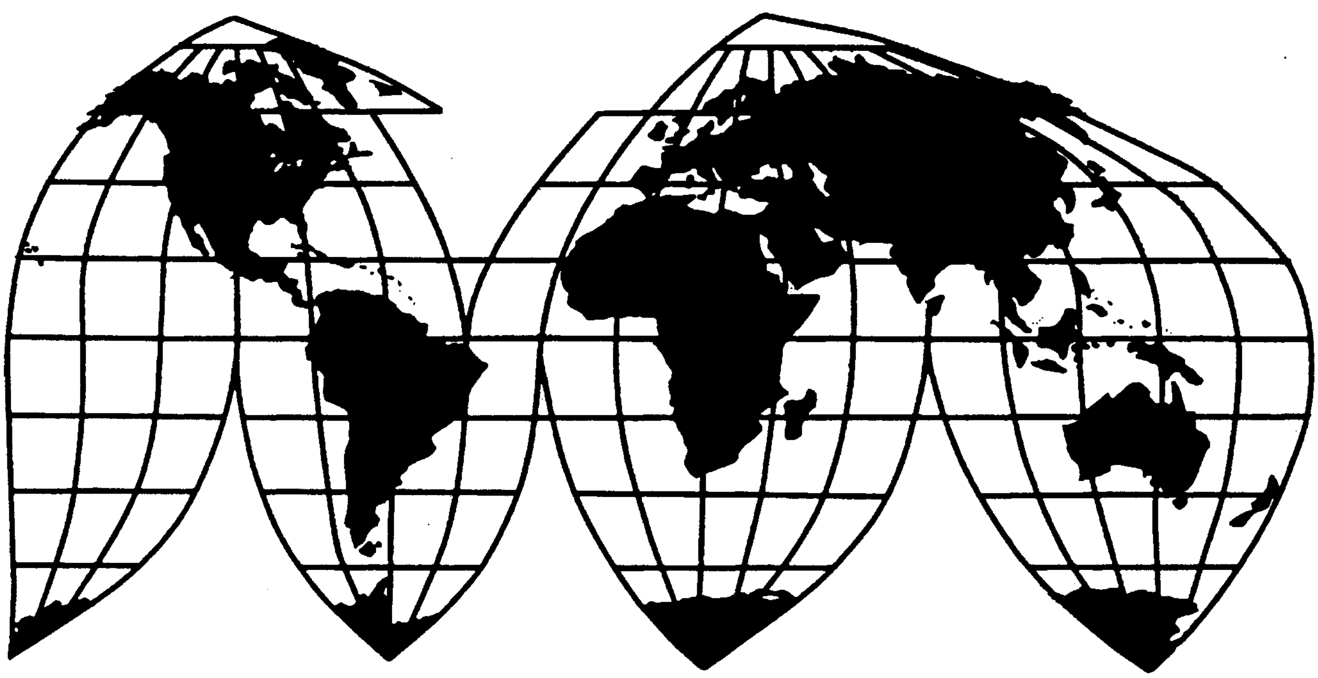
In the Matter of

Certain Rare-Earth Magnets and Magnetic Materials and Articles Containing Same

Investigation No. 337-TA-413

Publication 3307 **May 2000**

U.S. International Trade Commission



Washington, DC 20436

U.S. International Trade Commission

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U.S. International Trade Commission

Washington, DC 20436

In the Matter of

Certain Rare-Earth Magnets and Magnetic Materials and Articles Containing Same

Publication 3307

May 2000

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, DC 20436

In the Matter of CERTAIN RARE-EARTH MAGNETS AND MAGNETIC MATERIALS AND ARTICLES CONTAINING SAME	Inv. No. 337-TA-413

NOTICE OF ISSUANCE OF GENERAL EXCLUSION ORDER AND CEASE AND DESIST ORDERS; TERMINATION OF THE INVESTIGATION

AGENCY: U.S. International Trade Commission

ACTION: Notice

SUMMARY: Notice is hereby given that, having found violations of section 337 of the Tariff Act of 1930, 19 U.S.C. § 1337, the Commission issued a general exclusion order and cease and desist orders directed to three domestic respondents, and terminated the investigation.

FOR FURTHER INFORMATION CONTACT: Cynthia Johnson, Esq., Office of the General Counsel, U.S. International Trade Commission, telephone 202-205-3098. Hearing-impaired individuals are advised that information on this matter can be obtained by contacting the Commission's TDD terminal on 202-205-1810. General information concerning the Commission may also be obtained by accessing its Internet server (*http://www.usitc.gov*).

SUPPLEMENTARY INFORMATION: On September 4, 1998, the Commission instituted an investigation based on a complaint filed by Magnequench International, Inc. (Magnequench) and Sumitomo Special Metals Co., Ltd. (SSMC). 63 Fed. Reg. 47319. The complaint alleged violations of subsection (a)(1)(B) of section 337 in the importation into the United States, the sale for importation, or the sale within the United States after importation of certain rare-earth magnets or magnetic materials, or articles containing the same, that infringe claims 1, 4, 5, 8, 9, or 11 of U.S. Letters Patent 4,851,058, (the '058 patent); claims 1-6, 10, 14-16, or 18-20 of U.S. Letters Patent 4,802,931 (the '931 patent); claims 13-18 of U.S. Letters Patent 4,496,395 (the '395 patent); claims 1-9, 12-20, 23-27, or 29-34 of U.S. Letters Patent 4,770,723 (the '723 patent); claims 1-6, 8-10, 13-19, 21-24, 27-35, or 37-39 of U.S. Letters Patent 4,792,368 (the '368 patent); or claims 1-3, 5, 15, 18, 19, 21, or 22 of U.S. Patent Letters 5,645,651 (the '651 patent).

On September 22, 1999, the Commission determined not to review an initial determination (ID) granting complainants motion to withdraw from the investigation claims 1, 12, 23, 29, 30, and 32 of the '723 patent and claims 1, 13, 14, 22, 27, 32, 33, 34, and 39 of the '368 patent. Hence the claims in issue of the '723 patent and '368 patent are claims 2-9, 13-20, 24-27, 31, 33, and 34 of the '723 patent and claims 2-6, 8-10, 15-19, 21, 23, 24, 28-31, 35, 37, and 38 of the '368 patent.

The following respondents were named in the notice of investigation: Houghes International, Inc. (Houghes) of New York; International Magna Products, Inc. (IMI) of Indiana; Multi-Trend International Corp. a/k/a MTI-Modern Technology Inc. (Multi-Trend) of California; American Union Group, Inc. (AUG) of Maryland; High End Metals Corp. (High End) of Taiwan; Harvard Industrial America Inc. (Harvard) of California; H.T.I.E., Inc. (H.T.I.E.) of Pennsylvania; and CYNNY Magnets (CYNNY) of New Jersey.

On January 11, 1999, the Commission determined not to review an ID granting complainants' motion to amend the complaint and notice of investigation to add A.R.E., Inc. (A.R.E.) of Pennsylvania; NEOCO, L.C. (NEOCO) of Michigan; Beijing Jing Ma Permanent Magnets Materials Factory (Jing Ma) of China; and Xin Huan Technology Development Co., Ltd. (Xin Huan) of China as respondents.

On February 1, 1999, the Commission determined not to review an ID terminating the investigation as to respondent IMI on the basis of a consent order. On February 9, 1999, the Commission determined not to review IDs terminating the investigation as to respondents AUG, CYNNY, H.T.I.E., and Houghes on the basis of consent orders.

On May 25, 1999, the Commission determined not to review an ID granting complainants' motion for partial summary determination on the importation issue. On May 28, 1999, the Commission determined not to review an ID granting complainants' motion for summary determination on the domestic industry issue.

On August 6, 1999, the Commission determined not to review an ID finding respondents A.R.E., Jing Ma, and Xin Huan in default. On September 27, 1999, the Commission determined not to review an ID finding respondent Multi-Trend in default.

The prehearing conference and evidentiary hearing were conducted on June 9 to 18, 1999. Complainants, respondent NEOCO, and the Commission investigative attorneys (IAs) participated at the hearing. Following the filing of post-hearing submissions, closing arguments were heard on July 27, 1999.

On September 7, 1999, the ALJ issued his final ID finding a violation of section 337. His determination is based on his findings that the patents in issue are valid and enforceable, and that the accused imported magnets infringed all of the asserted claims, with the exception of claims 13-20, 25-27 and 33 of the '723 patent and claims 15-19, 21, 23, 24, 28, 30, 31, and 35 of the '368 patent. On October 25, 1999, the Commission determined not to review the ID, thereby finding a violation of section 337.

The remaining issues for the Commission to decide were (1) the appropriate remedy for the aforesaid violations, (2) whether the statutory public interest factors precluded such relief, and (3) the amount of the bond during the Presidential review period under 337(j). In making those determinations, the Commission took into account the presiding ALJ's recommended determination (RD) on permanent relief and bonding under 19 C.F.R. § 210.42(a)(2), as well as any written submissions from parties, the public, and other Federal agencies. The Commission solicited but did not receive submissions from other agencies or members of the public. The Commission received written submissions from complainants and the IAs that addressed the form of remedy, if any, that should be ordered, the effect of a remedy on the public interest, and the amount of bond that should be imposed during the 60-day Presidential review period. Complainants also filed a motion to file a sur-reply to the IAs' reply submission. That motion is hereby denied.

After considering the RD and the parties' submissions, the Commission determined that a general exclusion order is the appropriate remedy for the violations found in the subject investigation. The Commission also determined to issue three cease and desist orders directed to domestic respondents Multi-Trend, Harvard, and A.R.E.

The Commission also determined that the public interest factors enumerated in subsections (d) and (f) of section 337 do not preclude the issuance of the aforementioned general exclusion order and cease and desist orders, and that the bond during the Presidential review period shall be in the amount of 100 percent of the entered value of the articles in question.

This action is taken under the authority of section 337 of the Tariff Act of 1930, (19 U.S.C. § 1337), the Administrative Procedure Act, 5 U.S.C. §§ 551 *et seq*., and sections 210.45-210.51 of the Commission's Rules of Practice and Procedure, 19 C.F.R. §§ 210.45-210.51.

Nonconfidential versions of Commission's Order and its Opinion on Remedy, the Public Interest, and Bonding, and all other nonconfidential documents filed in the investigation are or will be available for public inspection during official business hours (8:45 a.m. to 5:15 p.m.) in the Commission's Office of the Secretary, Dockets Branch, 500 E Street, S.W., Room 112, Washington, D.C. 20436, telephone 202-205-1802.

By order of the Commission.

Donna R. Koehnke

Donna R. Koehnke
Secretary

Issued: December 9, 1999

CERTAIN RARE-EARTH MAGNETS AND MAGNETIC MATERIALS AND ARTICLES CONTAINING THE SAME

337-TA-413

PUBLIC CERTIFICATE OF SERVICE

I, Donna R. Koehnke, hereby certify that the attached **NOTICE OF ISSUANCE OF GENERAL EXCLUSION ORDER AND CEASE AND DESIST ORDERS; TERMINATION OF THE INVESTIGATION,** was served upon the following parties via first class mail and air mail where necessary on December 10, 1999.

Donna R. Koehnke
Donna R. Koehnke, Secretary
U.S. International Trade Commission
500 E Street, S.W., Rm. 112
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UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In the Matter of CERTAIN RARE-EARTH MAGNETS AND MAGNETIC MATERIALS AND ARTICLES CONTAINING SAME

Inv. No. 337-TA-413

GENERAL EXCLUSION ORDER

The Commission has determined that there is a violation of section 337 of the Tariff Act of 1930 (19 U.S.C. § 1337) in the unlawful importation and sale of certain rare earth magnets and magnetic materials that infringe claims of U.S. Letters Patent Nos. 4,851,058; 4,802,931; 4,496,395; 4,770,723; 4,792,368; and 5,645,651.

Having reviewed the record in this investigation, including the written submissions of the parties, the Commission has made its determination on the issues of remedy, the public interest, and bonding. The Commission has determined that a general exclusion from entry for consumption of articles is necessary to prevent circumvention of an exclusion order limited to products of named persons because there is a pattern of violation of section 337 and it is difficult to identify the source of infringing products. Accordingly, the Commission has determined to issue a general exclusion order prohibiting the unlicensed importation of infringing rare-earth magnets and magnetic materials.

The Commission has also determined that the public interest factors enumerated in subsections (d) and (f) of section 337 do not preclude the issuance of the general exclusion order and that the bond during the Presidential review period shall be in the amount of one hundred (100) percent of the entered value of the articles in question.

Accordingly, the Commission hereby **ORDERS** that:

1. Rare-earth magnets and magnetic materials covered by one or more of the following claims of the following patents:

    claims 1, 4, 5, 8, 9, and 11 of U.S. Letters Patent 4,851,058;

    claims 1-6, 10, 14-16, and 18-20 of U.S. Letters Patent 4,802,931;

    claims 13-18 of U.S. Letters Patent 4,496,395;

    claims 2-9, 24, 31, and 34 of U.S. Letters Patent 4,770,723;

    claims 2-6, 8-10, 29, 37, and 38 of U.S. Letters Patent 4,792,368; and

    claims 1-3, 5, 15, 18, 19, 21, and 22 of U.S. Letters Patent 5,645,651

    are excluded from entry for consumption, entry for consumption from a foreign-trade zone, and withdrawal from warehouse for consumption for the remaining terms of those patents, except under license of the patent owner or as provided by law.

2. Notwithstanding paragraph 1 of this Order, nothing in this Order shall apply to International Magna Products, Inc., American Union Group, Inc., CYNNY Magnets, H.T.I.E., Inc., or Houghes International, Inc., pursuant to paragraph 10 of the Consent Orders issued by the Commission on February 1 and 9, 1999.

3. Notwithstanding paragraph 1 of this Order, the aforesaid rare-earth magnets and magnetic materials are entitled to entry for consumption into the United States under bond in the amount of one hundred (100) percent of the entered value of such articles, from the day after this Order is received by the President, pursuant to subsection (j) of section 337 of the Tariff Act of 1930, as amended, until such time as the President notifies the Commission that he approves or disapproves this action, but no later than 60 days after the receipt of this Order by the President.

4. In accordance with subsection (l) of section 337, the provisions of this Order shall not apply to rare earth magnets or magnetic materials imported by and for the use of the United States, or imported for, and to be used for, the United States with the authorization or consent of the Government.

5. The Commission may modify this Order in accordance with the procedure described in section 210.76 of the Commission's Rules of Practice and Procedure (19 C.F.R. § 210.76).

6. The Secretary shall serve copies of this Order upon each party of record in this investigation, upon International Magna Products, Inc., American Union Group, Inc., CYNNY Magnets, H.T.I.E. Inc., and Houghes International, Inc., and upon the Department of Health and Human Services, the Department of Justice, the Federal Trade Commission, and the U.S. Customs Service.

7. Notice of this Order shall be published in the *Federal Register.*

By order of the Commission.

Donna R. Koehnke

Donna R. Koehnke
Secretary

Issued: December 10, 1999

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In the Matter of **CERTAIN RARE-EARTH MAGNETS AND MAGNETIC MATERIALS AND ARTICLES CONTAINING SAME**	**Inv. No. 337-TA-413**

ORDER TO CEASE AND DESIST

IT IS HEREBY ORDERED THAT Respondent cease and desist from conducting any of the following activities in the United States: importing, selling, marketing, advertising distributing, offering for sale, transferring (except for exportation), or soliciting U.S. agents or distributors for certain rare earth magnets and magnetic materials in violation of Section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337.

I.

(Definitions)

As used in this Order:

(A) "Commission" shall mean the U.S. International Trade Commission.

(B) "Complainants" shall mean Magnequench International, Inc. and Sumitomo Special Metals Co., Ltd., complainants in this investigation, and their successors and assigns.

(C) "Respondent" shall mean Multi-Trend International Corp., a/k/a MTI-Modern Technology, Inc., 43288 Christy Street, Fremont, CA 94538.

(D) "Person" shall mean an individual, or any nongovernmental partnership, firm, association, corporation, or other legal or business entity other than the Respondent or its majority owned or controlled subsidiaries, their successors, or assigns.

(E) "United States" shall mean the fifty states, the District of Columbia, and Puerto Rico.

(F) "Covered Product" shall mean rare earth magnets and magnetic materials that infringe one or more of the following claims of one or more of the following patents:

claims 1, 4, 5, 8, 9, and 11 of U.S. Letters Patent 4,851,058;

claims 1-6, 10, 14-16, and 18-20 of U.S. Letters Patent 4,802,931;

claims 13-18 of U.S. Letters Patent 4,496,395;

claims 2-9, 24, 31, and 34 of U.S. Letters Patent 4,770,723;

claims 2-6, 8-10, 29, 37, and 38 of U.S. Letters Patent 4,792,368; and

claims 1-3, 5, 15, 18, 19, 21, and 22 of U.S. Letters Patent 5,645,651.

(G) The terms "import" and "importation" refer to entry for consumption, entry for consumption from a foreign-trade zone, and withdrawal from warehouse for consumption under the Customs Laws of the United States.

II.

(Applicability)

The provisions of this Order shall apply to Respondent and any of its principals, stockholders, officers, directors, employees, agents, licenses, distributors, controlled (whether by stock ownership or otherwise) and/or majority owned business entities, successors, and assigns, and to each of them, insofar as they are engaging in conduct prohibited by Section III,

infra, for, with, or otherwise on behalf of Respondent.

III.

(Conduct Prohibited)

The following conduct of the Respondent in the United States is prohibited by the Order. The Respondent shall not:

(A) import or sell for importation into the United States covered product except under license of the patent owner;

(B) market, distribute, offer for sale, sell, or otherwise transfer (except for exportation) in the United States imported covered product except under license of the patent owner;

(C) advertise imported covered product except under license of the patent owner;

(D) solicit U.S. agents or distributors for imported covered product except under license of the patent owner; or

(E) aid or abet other entities in the importation, sale for importation, sale after importation, transfer, or distribution of covered product, except under license of the patent owner.

IV.

(Conduct Permitted)

Notwithstanding any other provision of this Order, specific conduct otherwise prohibited by the terms of this Order shall be permitted if, in a written instrument, the patent owner licenses or authorizes such specific conduct, or such specific conduct is related to the importation or sale of covered product by or for the United States.

V.

(Reporting)

For purposes of this reporting requirement, the reporting period shall commence on July 1 of each year and shall end on the subsequent June 30. However, the first report required under this section shall cover the period from the date of issuance of this Order through June 30, 2000. This reporting requirement shall continue in force until such time as the Respondent will have truthfully reported, in two consecutive timely filed reports, that it has no inventory of covered product in the United States.

Within thirty (30) days of the last day of the reporting period, Respondent shall report to the Commission the quantity in units and the value in dollars of foreign-made covered product that Respondent has imported and sold in the United States during the reporting period and the quantity and value of foreign-made covered product that remains in inventory at the end of the reporting period.

Any failure to make the required report or the filing of any false or inaccurate report shall constitute a violation of this Order and may be referred to the U.S. Department of Justice as a possible criminal violation of 18 U.S.C. § 1001.

VI.

(Record Keeping and Inspection)

(A) For purposes of securing compliance with this Order, Respondent shall retain any and all records to the sale, offer for sale, marketing, or distribution in the United States of imported covered product made and received in the usual and ordinary course of business, whether in detail or in summary form, for a period of two (2) years from the close of the fiscal

year to which they pertain.

(B) For the purposes of determining or securing compliance with this Order and for no other purpose, and subject to any privilege recognized by the federal courts of the United States, duly authorized representatives of the Commission upon reasonable written notice by the Commission or its staff, shall be permitted access and the right to inspect and copy in Respondent's principal offices during office hours, and in the presence of counsel or other representatives if Respondent so chooses, all books, ledgers, accounts, correspondence, memoranda, and other records and documents, both in detail and in summary form as are required to be retained by subsection VI(A) of this Order.

VII.

(Service of Cease and Desist Order)

Respondent is ordered and directed to:

(A) Serve, within fifteen (15) days after the effective date of this Order, a copy of this Order upon each of its respective officers, directors, managing agents, agents, and employees who have any responsibility for the marketing, distribution, or sale of imported covered product in the United States;

(B) Serve, within fifteen (15) days after the succession of any persons referred to in subsection VII(A) of this Order, a copy of the Order upon each successor; and

(C) Maintain such records as will show the name, title, and address of each person upon whom the Order has been served, as described in subsections VII(A) and VII(B) of this Order, together with the date on which service was made.

The obligations set forth in subsections VII(B) and VII(C) of this Order shall remain in

effect until the expiration date of the last to expire of the patents specified in Section I above.

VIII.

(Confidentiality)

Any request for confidential treatment of information obtained the Commission pursuant to Sections V and VI of the Order should be in accordance with section 201.6 of the Commission's Rules of Practice and Procedure, 19 C.F.R. § 201.6. For all reports for which confidential treatment is sought, Respondent must provide a public version of such report with confidential information redacted.

IX.

(Enforcement)

Violation of this Order may result in any of the actions specified in section 210.75 of the Commission's Rules of Practice and Procedure, 19 C.F.R. § 210.75, including an action for civil penalties in accordance with section 337(f) of the Tariff Act of 1930, 19 U.S.C. § 1337(f), and any other action the Commission may deem appropriate. In determining whether Respondent is in violation of this Order, the Commission may infer facts adverse to Respondent if Respondent fails to provide adequate or timely information.

X.

(Modification)

The Commission may amend this Order on its own motion or in accordance with the procedure described in section 210.76 of the Commission's Rules of Practice and Procedure, 19 C.F.R. § 210.76.

XI.

(Bonding)

The conduct prohibited by Section III of this Order may be continued during the sixty (60) day period in which this Order is under review by the President pursuant to section 337(j) of the Tariff Act of 1930, 19 U.S.C. § 1337(j), subject to Respondent posting a bond in the amount of one hundred (100) percent of the entered value of the articles in question. This bond provision does not apply to conduct that is otherwise permitted by Section IV of this Order. Covered product imported on or after the date of issuance of this Order is subject to the entry bond as set forth in the general exclusion order issued by the Commission simultaneously herewith, and is not subject to this bond provision.

The bond is to be posted in accordance with the procedures established by the Commission for the posting of bonds by complainants in connection with the issuance of temporary exclusion orders (19 C.F.R. § 210.68). The bond and any accompanying documentation is to be provided to and approved by the Commission prior to the commencement of conduct which is otherwise prohibited by Section III of this Order.

The bond is to be forfeited in the event that the President approves, or does not disapprove within the Presidential review period, this Order, unless the U.S. Court of Appeals for the Federal Circuit, in a final judgment, reverses the Commission final determination and order as to Respondent on appeal, or unless Respondent exports the products subject to this bond or destroys them and provides certification to that effect satisfactory to the Commission.

The bond is to be released in the event the President disapproves this Order and no subsequent order is issued by the Commission and approved, or not disapproved, by the President, upon service on Respondent of an order issued by the Commission based upon application therefor made by Respondent to the Commission.

By Order of the Commission.

Donna R. Koehnke

Donna R. Koehnke
Secretary

Issued: December 10, 1999

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In the Matter of **CERTAIN RARE-EARTH MAGNETS AND MAGNETIC MATERIALS AND ARTICLES CONTAINING SAME**	**Inv. No. 337-TA-413**

ORDER TO CEASE AND DESIST

IT IS HEREBY ORDERED THAT Respondent cease and desist from conducting any of the following activities in the United States: importing, selling, marketing, advertising distributing, offering for sale, transferring (except for exportation), or soliciting U.S. agents or distributors for certain rare earth magnets and magnetic materials in violation of Section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337.

I.

(Definitions)

As used in this Order:

(A) "Commission" shall mean the U.S. International Trade Commission.

(B) "Complainants" shall mean Magnequench International, Inc. and Sumitomo Special Metals Co., Ltd., complainants in this investigation, and their successors and assigns.

(C) "Respondent" shall mean Harvard Industrial America, Inc., 470 Nibus Street, Brea, California, 92621.

(D) "Person" shall mean an individual, or any nongovernmental partnership, firm, association, corporation, or other legal or business entity other than the Respondent or its majority owned or controlled subsidiaries, their successors, or assigns.

(E) "United States" shall mean the fifty states, the District of Columbia, and Puerto Rico.

(F) "Covered Product" shall mean rare earth magnets and magnetic materials that infringe one or more of the following claims of one or more of the following patents:

claims 1, 4, 5, 8, 9, and 11 of U.S. Letters Patent 4,851,058;

claims 1-6, 10, 14-16, and 18-20 of U.S. Letters Patent 4,802,931;

claims 13-18 of U.S. Letters Patent 4,496,395;

claims 2-9, 24, 31, and 34 of U.S. Letters Patent 4,770,723;

claims 2-6, 8-10, 29, 37, and 38 of U.S. Letters Patent 4,792,368; and

claims 1-3, 5, 15, 18, 19, 21, and 22 of U.S. Letters Patent 5,645,651.

(G) The terms "import" and "importation" refer to entry for consumption, entry for consumption from a foreign-trade zone, and withdrawal from warehouse for consumption under the Customs Laws of the United States.

II.

(Applicability)

The provisions of this Order shall apply to Respondent and any of its principals, stockholders, officers, directors, employees, agents, licenses, distributors, controlled (whether by stock ownership or otherwise) and/or majority owned business entities, successors, and assigns, and to each of them, insofar as they are engaging in conduct prohibited by Section III,

infra, for, with, or otherwise on behalf of Respondent.

III.

(Conduct Prohibited)

The following conduct of the Respondent in the United States is prohibited by the Order. The Respondent shall not:

(A) import or sell for importation into the United States covered product except under license of the patent owner;

(B) market, distribute, offer for sale, sell, or otherwise transfer (except for exportation) in the United States imported covered product except under license of the patent owner;

(C) advertise imported covered product except under license of the patent owner;

(D) solicit U.S. agents or distributors for imported covered product except under license of the patent owner; or

(E) aid or abet other entities in the importation, sale for importation, sale after importation, transfer, or distribution of covered product, except under license of the patent owner.

IV.

(Conduct Permitted)

Notwithstanding any other provision of this Order, specific conduct otherwise prohibited by the terms of this Order shall be permitted if, in a written instrument, the patent owner licenses or authorizes such specific conduct, or such specific conduct is related to the importation or sale of covered product by or for the United States.

V.

(Reporting)

For purposes of this reporting requirement, the reporting period shall commence on July 1 of each year and shall end on the subsequent June 30. However, the first report required under this section shall cover the period from the date of issuance of this Order through June 30, 2000. This reporting requirement shall continue in force until such time as the Respondent will have truthfully reported, in two consecutive timely filed reports, that it has no inventory of covered product in the United States.

Within thirty (30) days of the last day of the reporting period, Respondent shall report to the Commission the quantity in units and the value in dollars of foreign-made covered product that Respondent has imported and sold in the United States during the reporting period and the quantity and value of foreign-made covered product that remains in inventory at the end of the reporting period.

Any failure to make the required report or the filing of any false or inaccurate report shall constitute a violation of this Order and may be referred to the U.S. Department of Justice as a possible criminal violation of 18 U.S.C. § 1001.

VI.

(Record Keeping and Inspection)

(A) For purposes of securing compliance with this Order, Respondent shall retain any and all records to the sale, offer for sale, marketing, or distribution in the United States of imported covered product made and received in the usual and ordinary course of business, whether in detail or in summary form, for a period of two (2) years from the close of the fiscal

year to which they pertain.

(B) For the purposes of determining or securing compliance with this Order and for no other purpose, and subject to any privilege recognized by the federal courts of the United States, duly authorized representatives of the Commission upon reasonable written notice by the Commission or its staff, shall be permitted access and the right to inspect and copy in Respondent's principal offices during office hours, and in the presence of counsel or other representatives if Respondent so chooses, all books, ledgers, accounts, correspondence, memoranda, and other records and documents, both in detail and in summary form as are required to be retained by subsection VI(A) of this Order.

VII.

(Service of Cease and Desist Order)

Respondent is ordered and directed to:

(A) Serve, within fifteen (15) days after the effective date of this Order, a copy of this Order upon each of its respective officers, directors, managing agents, agents, and employees who have any responsibility for the marketing, distribution, or sale of imported covered product in the United States;

(B) Serve, within fifteen (15) days after the succession of any persons referred to in subsection VII(A) of this Order, a copy of the Order upon each successor; and

(C) Maintain such records as will show the name, title, and address of each person upon whom the Order has been served, as described in subsections VII(A) and VII(B) of this Order, together with the date on which service was made.

The obligations set forth in subsections VII(B) and VII(C) of this Order shall remain in

effect until the expiration date of the last to expire of the patents specified in Section I above.

VIII.

(Confidentiality)

Any request for confidential treatment of information obtained the Commission pursuant to Sections V and VI of the Order should be in accordance with section 201.6 of the Commission's Rules of Practice and Procedure, 19 C.F.R. § 201.6. For all reports for which confidential treatment is sought, Respondent must provide a public version of such report with confidential information redacted.

IX.

(Enforcement)

Violation of this Order may result in any of the actions specified in section 210.75 of the Commission's Rules of Practice and Procedure, 19 C.F.R. § 210.75, including an action for civil penalties in accordance with section 337(f) of the Tariff Act of 1930, 19 U.S.C. § 1337(f), and any other action the Commission may deem appropriate. In determining whether Respondent is in violation of this Order, the Commission may infer facts adverse to Respondent if Respondent fails to provide adequate or timely information.

X.

(Modification)

The Commission may amend this Order on its own motion or in accordance with the procedure described in section 210.76 of the Commission's Rules of Practice and Procedure, 19 C.F.R. § 210.76.

XI.

(Bonding)

The conduct prohibited by Section III of this Order may be continued during the sixty (60) day period in which this Order is under review by the President pursuant to section 337(j) of the Tariff Act of 1930, 19 U.S.C. § 1337(j), subject to Respondent posting a bond in the amount of one hundred (100) percent of the entered value of the articles in question. This bond provision does not apply to conduct that is otherwise permitted by Section IV of this Order. Covered product imported on or after the date of issuance of this Order is subject to the entry bond as set forth in the general exclusion order issued by the Commission simultaneously herewith, and is not subject to this bond provision.

The bond is to be posted in accordance with the procedures established by the Commission for the posting of bonds by complainants in connection with the issuance of temporary exclusion orders (19 C.F.R. § 210.68). The bond and any accompanying documentation is to be provided to and approved by the Commission prior to the commencement of conduct which is otherwise prohibited by Section III of this Order.

The bond is to be forfeited in the event that the President approves, or does not disapprove within the Presidential review period, this Order, unless the U.S. Court of Appeals for the Federal Circuit, in a final judgment, reverses the Commission final determination and order as to Respondent on appeal, or unless Respondent exports the products subject to this bond or destroys them and provides certification to that effect satisfactory to the Commission.

The bond is to be released in the event the President disapproves this Order and no subsequent order is issued by the Commission and approved, or not disapproved, by the President, upon service on Respondent of an order issued by the Commission based upon application therefor made by Respondent to the Commission.

By Order of the Commission.

Donna R. Koehnke

Donna R. Koehnke
Secretary

Issued: December 10, 1999

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In the Matter of **CERTAIN RARE-EARTH MAGNETS AND MAGNETIC MATERIALS AND ARTICLES CONTAINING SAME**

Inv. No. 337-TA-413

ORDER TO CEASE AND DESIST

IT IS HEREBY ORDERED THAT Respondent cease and desist from conducting any of the following activities in the United States: importing, selling, marketing, advertising distributing, offering for sale, transferring (except for exportation), or soliciting U.S. agents or distributors for certain rare earth magnets and magnetic materials in violation of Section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337.

I.

(Definitions)

As used in this Order:

(A) "Commission" shall mean the U.S. International Trade Commission.

(B) "Complainants" shall mean Magnequench International, Inc. and Sumitomo Special Metals Co., Ltd., complainants in this investigation, and their successors and assigns.

(C) "Respondent" shall mean A.R.E., Inc. 782 Pearl Street or 777 Linden Street, Sharon, Pennsylvania 16146.

(D) "Person" shall mean an individual, or any nongovernmental partnership, firm, association, corporation, or other legal or business entity other than the Respondent or its majority owned or controlled subsidiaries, their successors, or assigns.

(E) "United States" shall mean the fifty states, the District of Columbia, and Puerto Rico.

(F) "Covered Product" shall mean rare earth magnets and magnetic materials that infringe one or more of the following claims of one or more of the following patents:

claims 1, 4, 5, 8, 9, and 11 of U.S. Letters Patent 4,851,058;

claims 1-6, 10, 14-16, and 18-20 of U.S. Letters Patent 4,802,931;

claims 13-18 of U.S. Letters Patent 4,496,395;

claims 2-9, 24, 31, and 34 of U.S. Letters Patent 4,770,723;

claims 2-6, 8-10, 29, 37, and 38 of U.S. Letters Patent 4,792,368; and

claims 1-3, 5, 15, 18, 19, 21, and 22 of U.S. Letters Patent 5,645,651.

(G) The terms "import" and "importation" refer to entry for consumption, entry for consumption from a foreign-trade zone, and withdrawal from warehouse for consumption under the Customs Laws of the United States.

II.

(Applicability)

The provisions of this Order shall apply to Respondent and any of its principals, stockholders, officers, directors, employees, agents, licenses, distributors, controlled (whether by stock ownership or otherwise) and/or majority owned business entities, successors, and assigns, and to each of them, insofar as they are engaging in conduct prohibited by Section III,

infra, for, with, or otherwise on behalf of Respondent.

III.

(Conduct Prohibited)

The following conduct of the Respondent in the United States is prohibited by the Order. The Respondent shall not:

(A) import or sell for importation into the United States covered product except under license of the patent owner;

(B) market, distribute, offer for sale, sell, or otherwise transfer (except for exportation) in the United States imported covered product except under license of the patent owner;

(C) advertise imported covered product except under license of the patent owner;

(D) solicit U.S. agents or distributors for imported covered product except under license of the patent owner; or

(E) aid or abet other entities in the importation, sale for importation, sale after importation, transfer, or distribution of covered product, except under license of the patent owner.

IV.

(Conduct Permitted)

Notwithstanding any other provision of this Order, specific conduct otherwise prohibited by the terms of this Order shall be permitted if, in a written instrument, the patent owner licenses or authorizes such specific conduct, or such specific conduct is related to the importation or sale of covered product by or for the United States.

V.

(Reporting)

For purposes of this reporting requirement, the reporting period shall commence on July 1 of each year and shall end on the subsequent June 30. However, the first report required under this section shall cover the period from the date of issuance of this Order through June 30, 2000. This reporting requirement shall continue in force until such time as the Respondent will have truthfully reported, in two consecutive timely filed reports, that it has no inventory of covered product in the United States.

Within thirty (30) days of the last day of the reporting period, Respondent shall report to the Commission the quantity in units and the value in dollars of foreign-made covered product that Respondent has imported and sold in the United States during the reporting period and the quantity and value of foreign-made covered product that remains in inventory at the end of the reporting period.

Any failure to make the required report or the filing of any false or inaccurate report shall constitute a violation of this Order and may be referred to the U.S. Department of Justice as a possible criminal violation of 18 U.S.C. § 1001.

VI.

(Record Keeping and Inspection)

(A) For purposes of securing compliance with this Order, Respondent shall retain any and all records to the sale, offer for sale, marketing, or distribution in the United States of imported covered product made and received in the usual and ordinary course of business, whether in detail or in summary form, for a period of two (2) years from the close of the fiscal

year to which they pertain.

(B) For the purposes of determining or securing compliance with this Order and for no other purpose, and subject to any privilege recognized by the federal courts of the United States, duly authorized representatives of the Commission upon reasonable written notice by the Commission or its staff, shall be permitted access and the right to inspect and copy in Respondent's principal offices during office hours, and in the presence of counsel or other representatives if Respondent so chooses, all books, ledgers, accounts, correspondence, memoranda, and other records and documents, both in detail and in summary form as are required to be retained by subsection VI(A) of this Order.

VII.

(Service of Cease and Desist Order)

Respondent is ordered and directed to:

(A) Serve, within fifteen (15) days after the effective date of this Order, a copy of this Order upon each of its respective officers, directors, managing agents, agents, and employees who have any responsibility for the marketing, distribution, or sale of imported covered product in the United States;

(B) Serve, within fifteen (15) days after the succession of any persons referred to in subsection VII(A) of this Order, a copy of the Order upon each successor; and

(C) Maintain such records as will show the name, title, and address of each person upon whom the Order has been served, as described in subsections VII(A) and VII(B) of this Order, together with the date on which service was made.

The obligations set forth in subsections VII(B) and VII(C) of this Order shall remain in

effect until the expiration date of the last to expire of the patents specified in Section I above.

VIII.

(Confidentiality)

Any request for confidential treatment of information obtained the Commission pursuant to Sections V and VI of the Order should be in accordance with section 201.6 of the Commission's Rules of Practice and Procedure, 19 C.F.R. § 201.6. For all reports for which confidential treatment is sought, Respondent must provide a public version of such report with confidential information redacted.

IX.

(Enforcement)

Violation of this Order may result in any of the actions specified in section 210.75 of the Commission's Rules of Practice and Procedure, 19 C.F.R. § 210.75, including an action for civil penalties in accordance with section 337(f) of the Tariff Act of 1930, 19 U.S.C. § 1337(f), and any other action the Commission may deem appropriate. In determining whether Respondent is in violation of this Order, the Commission may infer facts adverse to Respondent if Respondent fails to provide adequate or timely information.

X.

(Modification)

The Commission may amend this Order on its own motion or in accordance with the procedure described in section 210.76 of the Commission's Rules of Practice and Procedure, 19 C.F.R. § 210.76.

XI.

(Bonding)

The conduct prohibited by Section III of this Order may be continued during the sixty (60) day period in which this Order is under review by the President pursuant to section 337(j) of the Tariff Act of 1930, 19 U.S.C. § 1337(j), subject to Respondent posting a bond in the amount of one hundred (100) percent of the entered value of the articles in question. This bond provision does not apply to conduct that is otherwise permitted by Section IV of this Order. Covered product imported on or after the date of issuance of this Order is subject to the entry bond as set forth in the general exclusion order issued by the Commission simultaneously herewith, and is not subject to this bond provision.

The bond is to be posted in accordance with the procedures established by the Commission for the posting of bonds by complainants in connection with the issuance of temporary exclusion orders (19 C.F.R. § 210.68). The bond and any accompanying documentation is to be provided to and approved by the Commission prior to the commencement of conduct which is otherwise prohibited by Section III of this Order.

The bond is to be forfeited in the event that the President approves, or does not disapprove within the Presidential review period, this Order, unless the U.S. Court of Appeals for the Federal Circuit, in a final judgment, reverses the Commission final determination and order as to Respondent on appeal, or unless Respondent exports the products subject to this bond or destroys them and provides certification to that effect satisfactory to the Commission.

The bond is to be released in the event the President disapproves this Order and no subsequent order is issued by the Commission and approved, or not disapproved, by the President, upon service on Respondent of an order issued by the Commission based upon application therefor made by Respondent to the Commission.

By Order of the Commission.

Donna R. Koehnke

Donna R. Koehnke
Secretary

Issued: December 10, 1999

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, DC 20436

In the Matter of CERTAIN RARE-EARTH MAGNETS AND MAGNETIC MATERIALS AND ARTICLES CONTAINING SAME	Inv. No. 337-TA-413

COMMISSION OPINION ON REMEDY, THE PUBLIC INTEREST, AND BONDING

Background

This investigation was based on a complaint filed on July 31, 1998, under section 337 of the Tariff Act of 1930, as amended, on behalf of Magnequench International, Inc. (Magnequench) of Indiana and Sumitomo Special Metals Co., Ltd. (SSMC) of Japan (collectively "complainants"). The complaint alleged that there was a violation of subsection (a)(1)(B) of section 337 in the importation into the United States, the sale for importation, or the sale within the United States after importation of certain rare-earth magnets or magnetic materials, or articles containing the same, that infringe the following 95 patent claims: claims 1, 4, 5, 8, 9, or 11 of U.S. Letters Patent 4,851,058 (the '058 patent); claims 1-6, 10, 14-16, or 18-20 of U.S. Letters Patent 4,802,931 (the '931 patent); claims 13-18 of U.S. Letters Patent 4,496,395 (the '395 patent); claims 1-9, 12-20, 23-27, or 29-34 of U.S. Letters Patent 4,770,723 (the '723 patent); claims 1-6, 8-10, 13-19, 21-24, 27-35, or 37-39 of U.S. Letters Patent 4,792,368 (the '368 patent); or claims 1-3, 5, 15, 18, 19, 21, or 22 of U.S. Letters Patent 5,645,651 (the '651 patent); and whether there exists an industry in the United States as required by subsection (a)(2) of section 337.

The following firms were named as respondents in the Commission's notice of investigation: Houghes International, Inc. (Houghes) of New York; International Magna Products, Inc. (IMI) of Indiana; Multi-Trend International Corp. a/k/a MTI-Modern Technology Inc. (Multi-Trend) of California; American Union Group, Inc. (AUG) of Maryland; High End Metals Corp. (High End) of Taiwan; Harvard Industrial America Inc. (Harvard) of California; H.T.I.E., Inc. (H.T.I.E.) of Pennsylvania; and CYNNY Magnets (CYNNY) of New Jersey.

On January 11, 1999, the Commission determined not to review an initial determination (ID) granting complainants' motion to amend the complaint and notice of investigation to add A.R.E., Inc. (A.R.E.) of Pennsylvania; NEOCO, L.C. (NEOCO) of Michigan; Beijing Jing Ma Permanent Magnets Materials Factory (Jing Ma) of China; and Xin Huan Technology Development Co., Ltd. (Xin Huan) of China as respondents.

On February 1, 1999, the Commission determined not to review an ID terminating the investigation as to respondent IMI on the basis of a consent order. On February 9, 1999, the Commission determined not to review IDs terminating the investigation as to respondents AUG, CYNNY, H.T.I.E., and Houghes on the basis of consent orders.

On September 22, 1999, the Commission determined not to review an ID granting complainants' motion to withdraw from the investigation claims 1, 12, 23, 29, 30, and 32 of the '723 patent and claims 1, 13, 14, 22, 27, 32, 33, 34, and 39 of the '368 patent. Hence, the claims in issue of the '723 and '368 patents are claims 2-9, 13-20, 24-27, 31, 33, and 34 of the '723 patent and claims 2-6, 8-10, 15-19, 21, 23, 24, 28-31, 35, 37, and 38 of the '368 patent.

On May 25, 1999, the Commission determined not to review an ID granting complainants' motion for partial summary determination on the importation issue. On May 28, 1999, the Commission determined not to review an ID granting complainants' motion for summary determination on both the economic prong and the technical prong relating to domestic industry.

By letter to the ALJ dated May 11, 1999, counsel for respondents High End and Harvard represented as follows:

> Neither High End, nor Harvard, will be actively participating in the pre-hearing conference and hearing scheduled for June 9 - 18, 1999. Neither will be calling witnesses or expert witnesses at the hearing. Neither High End, Harvard, nor their counsel will be attending the hearing itself.

On August 6, 1999, the Commission determined not to review an ID finding respondents A.R.E., Jing Ma, and Xin Huan in default. On September 27, 1999, the Commission determined not to review an ID finding respondent Multi-Trend in default.

The prehearing conference and hearing were conducted on June 9 to 18, 1999. Complainants, respondent NEOCO, and the Commission investigative attorneys (IAs) (Mr. Fusco and Mr. Wood) participated at the hearing. Following the filing of post-hearing submissions, closing arguments were heard on July 27, 1999.

On September 7, 1999, the ALJ issued his final ID finding a violation of section 337. His determination is based on his finding that respondents infringed most of the asserted patent claims, all of which he found to be valid. On October 26, 1999, the Commission determined not to review that ID, thereby finding a violation of section 337.

The Commission must now decide the appropriate remedy for the aforesaid violations, whether the statutory public interest factors preclude such remedy, and the amount of the bond during the Presidential review period.[1] In making those determinations, the Commission is required to take into account the ALJ's recommended determination ("RD") on permanent relief and bonding, as well as any written submissions from parties, interested members of the public, or other Federal agencies.[2]

Remedy

A. General Exclusion Order

Section 337(d) of the Act provides that if the Commission determines, as a result of its investigation, that there is a violation of section 337, it may issue a limited or general exclusion order, subject to specified conditions.[3]

The ALJ recommended that we issue a general exclusion order in this investigation. The ALJ noted that the Commission has found a general exclusion order appropriate when there is proof of (1) a widespread pattern of unauthorized use of the patented invention, and (2) certain business conditions from which one might reasonably infer that foreign manufacturers other than respondents to the investigation may attempt to enter the U.S. market with infringing products, citing Certain Airless Paint Spray Pumps and Components Thereof, Inv. No. 337-TA-90, USITC Pub.1199 at 17 (1981) (Spray Pumps).

In 1994, Congress amended section 337(d) to provide that the Commission's authority to

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[1]See 19 C.F.R. § 210.50(a) and 19 U.S.C. § 1337 (d), (f), (g), and (j)(3).

[2]See 19 C.F.R. §§ 210.42(a)(2) and 210.54(a)(4). See also 19 U.S.C. § 1337(b)(2) and S. Rep. No. 1298, 93d Cong. 2d Sess. At 195 (1974).

[3]See generally 19 U.S.C. § 1337(d).

order the exclusion of articles from entry shall be confined to persons whom the Commission has determined to be violating section 337, unless the Commission determines that: (a) a general exclusion from entry of articles is necessary to prevent circumvention of an exclusion order limited to products of named persons; or (b) there is a pattern of violation of section 337 and it is difficult to identify the source of infringing products.[4] Those standards "do not differ significantly" from the Spray Pumps standards. Certain Neodymium-Iron-Boron Magnets, Inv. No. 337-TA-372, Commission Opinion on Remedy, the Public Interest and Bonding at 5, USITC Pub. No. 2964 (1996) (Magnets). See also Certain Agricultural Tractors Under 50 Power Take-Off Horsepower, Inv. No. 337-TA-380, 44 U.S.P.Q.2d 1385, 1397-1404 (1997) (general exclusion order granted) (Tractors). In Tractors, the Commission stated:

> In Spray Pumps, the Commission pointed out that a complainant should not be compelled to file a series of separate complaints against several individual foreign manufacturers as it becomes aware of their products in the U.S. market. Such a practice would not only waste the resources of the complainant, it would also burden the Commission with redundant investigations. (Comm'n Op. at 30).

That consideration must be balanced against the potential of a general exclusion order to disrupt legitimate trade. Id. With this balance in mind, the Commission concluded that it would - -

> require that a complainant seeking a general exclusion order prove both a widespread pattern of unauthorized use of its patented invention and certain business conditions from which one might reasonably infer that foreign manufacturers other than the respondents to the investigation may attempt to enter the U.S. market with infringing articles. Id.

The Commission in Spray Pumps set out the following factors as relevant in demonstrating whether there is a "widespread pattern of unauthorized use":

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[4] 19 U.S.C. § 1337(d)(2). See also Commission rule 210.50(c).

> (1) a Commission determination of unauthorized importation into the United States of infringing articles by numerous foreign manufacturers;
>
> (2) the pendency of foreign infringement suits based upon foreign patents which correspond to the domestic patent at issue; and
>
> (3) other evidence which demonstrates a history of unauthorized foreign use of the patented invention.

Id. The Commission also identified the factors relevant to showing "certain business conditions" as including:

> (1) an established market for the patented product in the U.S. market and conditions of the world market;
>
> (2) the availability of marketing and distribution networks in the United States for potential foreign manufacturers;
>
> (3) the cost to foreign entrepreneurs of building a facility capable of producing the patented article;
>
> (4) the number of foreign manufacturers whose facilities could be retooled to produce the patented article; or
>
> (5) the cost to foreign manufacturers of retooling their facility to produce the patented article.

Id. at 31-32.

In formulating his recommendation for a remedy, the ALJ considered evidence regarding respondents who had been terminated from the investigation on the basis of consent orders, citing Magnets, Comm'n Op. at 21, fn. 18. See also Woodworking Machines, Inv. No. 337-TA-174, USITC Pub. 1979 at 49 (1987) (Commission considered evidence regarding terminated respondents that had entered into consent orders in finding a pattern of widespread unauthorized use of the complainant's patents and trademarks). In addition to Commission precedent, the ALJ noted that ¶6 of the consent orders signed by the terminated respondents in this investigation provides that:

> [the respondent] understands and acknowledges that with regard to information it provided in the course of discovery in the Investigation, including but not limited to documents, interrogatory responses, transcripts of sworn deposition testimony, and sample magnets, Complainants may seek to introduce such information as evidence in the Investigation after [the respondent] has been terminated as a respondent.

Notice Of A Commission Determination Not To Review An Initial Determination Terminating One Respondent On The Basis Of Consent Order; Issuance Of Consent Order (February 1, 1999), and Notice Of A Commission Determination Not To Review Two Initial Determinations Terminating Four Respondents On The Basis Of Consent Orders; issuance Of Consent Orders (February 9, 1999).

The ALJ concluded there was a widespread pattern of unauthorized use of the patented invention. He found that each of former respondents AUG, CYNNY, Houghes, IMI, and H.T.I.E. imported, sold for importation, or sold after importation articles that infringe the patents in issue. ID at 152; FF 241, 264. Moreover, each of respondents ARE, NEOCO, High End, Harvard, Beijing Jing Ma, Xin Huan, and Multi-Trend imported, sold for importation, or sold after importation articles that infringe the patents in issue. Finally, he found that there was evidence that certain non-parties, viz., GEC and AIWA, had imported infringing magnets. ID at 152; FF 270-271.

The ALJ also found evidence of numerous foreign manufacturers. For example, he found that NEOCO conceded that it imported Nd-Fe-B magnets and magnetic materials from at least five different companies in China. ID at 152; FF 370. He also found that AUG acknowledged that it imported magnets from at least one company in China, and that AUG's invoices showed that it has imported Nd-Fe-B magnets from three other Chinese companies. ID at 152; FF 371. In addition, the ALJ found that H.T.I.E. imported from three Chinese sources. ID at 153; FF 372.

The ALJ found that information obtained through discovery and from public sources identified numerous nonrespondent companies that manufacture, sell for importation, or sell after importation Nd-Fe-B magnets and magnetic materials. For example, the ALJ found that a search on the Internet using the keyword "neodymium" retrieved web-sites for numerous companies offering to sell Nd-Fe-B magnets in the United States. ID at 153; FF 372. Similarly, he found that the Thomas Register, a trade publication commonly used by those in the magnet industry, contains listings from a substantial number of U.S. companies dealing in Nd-Fe-B magnets and magnetic materials. ID at 153; FF 374.

The ALJ found that the testimony of fact witnesses also confirmed that the subject magnets themselves have no identifying marks from which one can establish their source by visual inspection. ID at 153; FF 381. In addition, he found that the lack of identifying marks on the magnets imported from China can completely mask the identity of the foreign manufacturer since an import shipment is usually from a trading company and not from the manufacturer itself. ID at 153; FF 375-381.

With regard to the "certain business conditions" which constitute the second prong of the Spray Pumps test, the ALJ found that at least two of the factors or "business conditions" were satisfied. With respect to the first factor of "certain business conditions," viz., the existence of an established market for the patented product in the U.S. market and conditions of the world market, the ALJ found that testimony established that there is demand for Nd-Fe-B magnets in the United States. ID at 154; FF 383-389. He found evidence that Nd-Fe-B magnets are key components in a number of popular and/or economically important products, such as computer hard drives, magnetic resonance imagers, automobiles, a variety of industrial motors, and numerous consumer electronic products. ID at 154; FF 385-387.

Regarding the second factor, viz., the availability to foreign manufacturers of U.S. marketing and distribution networks, the ALJ found evidence that the channels available for the importation and distribution of infringing Nd-Fe-B magnets and magnetic materials are numerous and significant. He found that testimony confirmed that a number of U.S. firms are engaged in the importation and distribution of Nd-Fe-B magnets and magnetic materials in the United States. ID at 154; FF 390-397. Some of these firms, such as NEOCO, H.T.I.E., and A.U.G., imported Nd-Fe-B magnets and/or magnetic materials from a number of Chinese sources. ID at 154; FF 370, 371, 372. Others, such as Harvard, established a relationship with a single foreign source. ID at 154; FF 393. He found that three respondents (CYNNY, A.R.E., and I.M.I.) engaged in the distribution and sale of magnets imported by others. ID at 154; FF 394. CYNNY has also engaged in the distribution and sale of magnets imported by another firm not named as a respondent. ID at 154; FF 396. Likewise, the ALJ found that CYNNY and A.R.E. have imported Nd-Fe-B magnets directly from Chinese manufacturers. ID at 154; FF 379, 395, 398.

In addition, the ALJ found that the information needed in order for a Nd-Fe-B magnet and magnetic materials importer/distributor to establish sources of supply and a customer base was readily available. He noted that respondents testified in depositions that they and other Nd-Fe-B magnet importers, distributors, and marketers made use of various resources to market the Nd-Fe-B magnetic products, such as the Thomas Register and advertisements in trade journals. ID at 154-55; FF 374, 399-402. The ALJ found that these publications serve as a source of information for foreign manufacturers of Nd-Fe-B magnets to identify U.S. importers, distributors, and marketers for their products. They also serve as a resource for importers and distributors to find customers. ID at 155; FF 402. In addition, he found that magnet conferences, such as the China Magnet '98 Conference, also serve as a vehicle by which new entrants in the business can identify potential U.S. importers, marketers, and distributors. ID at 155; FF 399, 403.

While the ALJ found no evidence in the record regarding the third factor, viz., the cost to foreign entrepreneurs of building a facility capable of producing the patented article, he did find evidence that there is a large number of other foreign, particularly Chinese, manufacturers of Nd-Fe-B magnets with substantial production capacity. Testimony from witnesses placed the number of Nd-Fe-B magnet factories in China at over 100. ID at 155; FF 404. Moreover, a consultant knowledgeable regarding the Chinese Nd-Fe-B magnet and magnetic materials industry reported that over 100 factories in China manufacture these materials, with at least 15 of them having production capacity of over 150 tons a year. ID at 155; FF 404, 405.

The ALJ found that the evidence confirmed that a number of foreign manufacturers exported Nd-Fe-B magnets and magnetic materials to the United States. A number of importer respondents testified that they had imported from a number of other foreign sources in addition to those named as respondents. ID at 156; FF 398.

While the ALJ found no evidence in the record with respect to the fourth and fifth factors, viz., the number of foreign manufacturers whose facilities could be retooled to produce the patented article, and the cost to foreign manufacturers of retooling their facility to produce the patented article, he did find evidence that such retooling can be easily done by factories that produce other types of magnets. ID at 156-57.

In addition, the ALJ rejected respondent NEOCO's argument that a general exclusion order would reach too far by denying to the U.S. market products available under the U.S. Navy's U.S. patents licensed to NEOCO. Specifically, NEOCO argued that any remedy should be tailored "to protect respondent NEOCO as an importer acting [as a licensee of the Navy] under three valid United States patents." However, the ALJ found that NEOCO's status as a licensee of the Navy had no bearing on its status as an infringer of the patents in issue in this investigation. ID at 157. In light of all of the evidence, the ALJ recommended issuance of a general exclusion order as an appropriate remedy. ID at 158.

We agree with the ALJ. The facts in this investigation meet the statutory standard, i.e., that (a) a general exclusion order is necessary to prevent circumvention of an exclusion order limited to the products of named persons, or (b) there is a pattern of violation of section 337 and it is difficult to identify the source of the infringing products.[5] In addition, the criteria that the ALJ applied is consistent with Commission precedent beginning with Spray Pumps. We therefore determine that a general exclusion order under section 337(d) is the appropriate remedy for the violations found in this investigation.

1. Certification

[5] 19 U.S.C. 1337(d)(2) and 19 C.F.R. 210.50(c).

Before the ALJ, complainants proposed two certification requirements, viz., (1) a requirement that importers of shipments purporting to be motors, generators, certain electronic products, and rare earth metals certify that their import shipments are not shipments of Nd-Fe-B magnets or magnetic materials; and (2) a requirement that importers of certain downstream products, viz., speakers, headphones, and motors, certify that their products do not contain infringing Nd-Fe-B magnets. ID at 161. Complainants requested the former requirement because there is some evidence in the record of this investigation that some import shipments of magnets are not labeled as such. Complainants later indicated that they were no longer seeking certification of downstream products.

The ALJ recommended that the Commission not impose either of the certification requirements proposed by complainants because he found that the danger of unduly disrupting legitimate trade through the proposed certification requirements appeared to be considerable. With respect to the first request, he found that although there are at least some magnets imported under labels that do not make it clear that they are magnets, ID at 162, the proposed certification would affect third parties who do not manufacture the infringing goods. He found that under the first proposed certification requirement, all importers of, for example, AC motor parts would be required to certify that their import shipments are not magnets even if the shipments contain no magnets at all, and that all importers of gears, sprockets, motor housings, etc. would be required to certify that their import shipments are not magnets, notwithstanding the fact that gears, sprockets, etc. are not magnets. The ALJ found complainants' proposed certification procedures similar to the broad based certification procedure that Customs expressed concern about in Certain Electrical Connectors and Products Containing Same, ("Connectors") ITC Inv. No. 337-

TA-374, USITC Pub. 2981, and found that the proposed procedures would be "highly burdensome to the numerous importers" and would be highly burdensome to Customs in that it would "entail the processing of large numbers of paper documents." Connectors at 10.[6] ID at 162. Therefore, in light of the potential disruption of trade in legitimate goods that are not even remotely connected with the patented magnets, and in view of the burden on Customs, the ALJ found that such relief was not warranted. ID at 162.

Moreover, the ALJ found suspect the enforceability of a certification procedure that would require an importer to certify that its import shipment is not in fact magnets. In view of the evidence that some import shipments of magnets are mislabeled, ID at 162, the ALJ reasoned that it was likely that importers who mislabel their shipments would also be willing to make a false certification to Customs, thus rendering the certification procedure useless. In fact, the

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[6] In Connectors, the Commission determined that "[o]n the facts of this investigation," there was justification for exclusion of motherboards containing infringing electrical connectors; that while the actual value of the electrical connectors in relation to the value of the motherboard appeared to be small, . . . the motherboard was rendered useless as it was incapable of receiving memory card; and that exclusion of motherboards was warranted to ensure that exclusion was effective. Connectors at 11. The Commission determined, however, that it would be highly burdensome to importers and Customs to require that all imports of motherboards either be certified as containing non-infringing electrical connectors or excluded, and therefore determined that it would be appropriate to limit the certification requirement by permitting Customs the discretion to determine when to require such certification. Id. at 15. In limiting the exclusion order, the Commission recognized Customs concerns regarding a broad based certification requirement:

> However, Customs indicated to the [Commission investigative attorney] its view that a certification provision that required all importers of motherboards to certify that their products do not contain infringing Hon Hai/Foxconn connectors would be highly burdensome to the numerous importers of motherboards. Such a broad certification requirement would burden Customs inasmuch as the certification procedure would entail the processing of large numbers of paper documents.

Id. at 10 (Emphasis in original).

Commission has held that such a certification procedure would be ineffective in the Nd-Fe-B magnet market. In the prior Magnets investigation, the Commission stated:

> The willingness on the part of importers to misdescribe or mislabel goods to Customs suggests that they would be equally willing to falsify a certification to Customs. Thus, a general exclusion order which allowed certification would be ineffective at barring the entry of infringing Nd-Fe-B magnets, and thus, ineffective at affording complainant complete relief.

Magnets, at 11. Before the ALJ, complainants argued that the decision in Magnets concerning the impropriety of a certification procedure did not preclude a certification procedure in this investigation because the "...certification issue in this case differs significantly from the certification issue addressed in the earlier magnets case...." ID at 163, *citing* Tr. at 2102-2103. The ALJ agreed with complainants that the certification procedure requested in the prior Magnets investigation differs from the procedures requested in this investigation because the certification procedure requested in the earlier investigation involved the importer certifying that its shipment contained non-infringing magnets based on its own analysis, whereas the certification requested in this investigation would merely require the importer to certify that its shipment is not in fact magnets at all. However, the ALJ determined that such differences do not bear on the Commission's premise that the willingness on the part of importers to misdescribe or mislabel goods to Customs suggests that they would be equally willing to falsify a certification to Customs. Thus, the ALJ rejected complainants' request that importers of certain products be made to certify that their shipments were not in fact magnets. ID at 163.

Complainants continued to argue before the Commission that a certification provision directed at mislabeled shipments is necessary because of the widespread practice of mislabeling shipments, and that such mislabeling would, absent certification, result in circumvention of any remedy granted by the Commission.[7] Complainants assert that the evidence shows that the products under investigation are entering the country in significant volume with documentation and under HTS headings that mask the fact that the shipments actually contain infringing magnets. They argue that a certification provision requiring importers of products covered by the HTS headings under which many of the magnets and magnetic materials are improperly imported, to certify that the shipment is not, in fact, a shipment of magnets or magnetic materials is a reasonable solution to the problem.

The Commission IAs argued before the Commission that complainants failed to show that their need for a broader remedy outweighs the added burden of their proposed mislabeled magnets certification procedure. They assert that in 1998, over $3.1 billion in imports of articles under complainants' three HTS headings entered the United States. Moreover, the IAs point out that because individual shipments in these categories are often of a small dollar amount, the number of individual shipments making up the imports affected by the proposed certification is enormous. The IAs also investigated the dollar volume of trade that would be affected if complainants' proposed certification procedure were applied to a smaller subset of HTS classifications, but found that even if the scope of the proposed certification provision is narrowed, the volume of affected trade would still be over $1 billion in 1998.[8]

The IAs disagree with complainants' contention that the proposed certification requirement would not be disruptive of legitimate trade. They argue that additional paperwork

[7] Complainants' Brief on Remedy, Public Interest, and Bonding at 22.
[8] OUII's Reply Brief on Remedy, the Public Interest, and Bonding at 4, n.5.

and delays in clearing of Customs can be disruptive. They contend that these delays, combined with the administrative burden that would be borne by Customs, render the proposed provision unduly burdensome.

We decline to include in the general exclusion order a certification provision which would require importers in certain HTS categories to certify that their imports do not contain magnets. We find that the certification requirement proposed by complainant would impose an unduly disruptive burden on importers and Customs, not a *de minimis* burden as complainants contend. The certification requested by complainants would cover $3.1 billion in imports using 1998 import statistics. By comparison, the total dollar value of imports in HTS 8505.11.0000, the proper category for importing the subject rare-earth magnets, was approximately $95 million. Hence, complainants are asking for certification of goods with a value over 30 times that of the properly classified goods. We believe that such a requirement would likely result in Customs delays for importers and a substantial administrative burden on Customs. We believe that the excessive burden on Customs and importers outweighs any benefits to complainants. While we are cognizant of the evidence that there is some mislabeling of imports of rare earth magnets, it is like the ALJ reasoned, likely that importers who mislabel their shipments would also be willing to make a false certification to Customs, thus rendering the certification procedure ineffective.

B. Cease and Desist Orders

Section 337(f) permits the Commission to issue, in lieu of or in addition to an exclusion order, a cease and desist order directing persons found to have violated section 337 "to cease and desist from engaging in the unfair methods or acts involved ...." The Commission has stated that: "In general, cease and desist orders are warranted with respect to domestic respondents that maintain commercially significant U.S. inventories of the infringing product." Domestic respondents who have been found in default under Commission rule 210.6 are presumed to maintain significant inventories of infringing products in the United States and are subject to cease and desist orders. Tractors, 44 U.S.P.Q.2d 1385, 1404, n. 124 (Fed. Cir. 1997).

The ALJ recommended that cease and desist orders be issued against domestic respondents A.R.E., Multi-Trend, and Harvard. A.R.E. and Multi-Trend were found in default pursuant to Commission rule 210.16. Mr. Chiang of Multi-Trend in a declaration (see Order No. 60) declared that the amount of product in question involving Multi-Trend is only approximately $900. The ALJ found no evidence to corroborate the declaration that only $900 worth of product was involved. With respect to Harvard, the ALJ noted that it did not participate at the hearing nor file any posthearing submissions denying the existence of inventory. Therefore, the ALJ drew an adverse inference of commercially significant U.S. inventories against Harvard pursuant to Commission rule 210.17. ID at 168. With respect to NEOCO, the ALJ found no evidence in the record to support a finding that NEOCO maintains a significant U.S. inventory of infringing magnets. ID at 167.

Complainants and the IAs support the issuance of cease and desist orders against Harvard, A.R.E., and Multi-Trend. Complainants argue that a cease and desist order should also be entered against NEOCO; the IAs disagree. Complainants argue that [[

]].[9] The IAs argue that there is no evidence that NEOCO currently has a commercially significant inventory of infringing magnets.[10]

We have issued cease and desist orders against A.R.E., Multi-Trend, and Harvard, but not against NEOCO. A.R.E. and Multi-Trend were found in default in this investigation, and Harvard did not participate in the hearing. Given the lack of evidence of inventories because of their failure to participate, we agree with the ALJ's drawing of adverse inferences against these respondents and agree that the consequent issuance of cease and desist orders is appropriate. With respect to NEOCO, we agree with the ALJ's assessment that the record evidence is inadequate to support a conclusion that NEOCO presently holds significant inventories of rare-earth magnets or magnetic materials.

The Public Interest

The Commission may issue an exclusion order "unless after considering the effect of such exclusion upon the public health and welfare, competitive conditions in the United States economy, the production of like or directly competitive articles in the United States, and United States consumers, it finds that such articles should not be excluded from entry."[11] The public interest must be paramount in the administration of section 337.[12] As the legislative history explains:

> Should the Commission found that issuing an exclusion order would have a greater adverse impact on the public health and welfare; on competitive conditions in the United States economy; on production of like or directly competitive articles in the

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[9] Complainants' Brief on Remedy, Public Interest, and Bonding at 31.
[10] OUII's Reply Brief on Remedy, Public Interest, and Bonding at 6.
[11] 19 U.S.C. § 1337(d)(1). See also 19 C.F.R. § 210.50(a)(2).
[12] See S. Rept. No. 1298 at 193.

> United States; or on the United States consumer, than would be gained by protecting the patent holder (within the context of the U.S. patent laws) then the Committee feels that such exclusion order should not be issued.[13]

We note that the rare-earth magnets covered by the patent claims at issue are manufactured by several licensed entities in addition to the two complainants, so that U.S. purchasers have the option of sources other than unlicensed manufacturers of infringing articles. We note also that the magnets and magnetic materials at issue do not have uses or applications relating to the public health and welfare and, hence, the exclusion of infringing imports is not likely to have any significant impact upon that aspect of the public interest. We are unaware of any public interest factors that would militate against the entry of a general exclusion order. On the contrary, the public interest favors the protection of U.S. intellectual property rights by excluding infringing imports.

Bonding

Because the Commission entered a general exclusion order, infringing imported rare-earth magnets and magnetic materials will be entitled to entry under a bond prescribed by the Secretary of the Treasury, in an amount determined by the Commission, until the order becomes final or is disapproved by the President.[14] If the President approves the order or takes no action and allows the order to become final, the bond may be forfeited to the complainant under terms and conditions prescribed by the Commission.[15] The Commission must set the amount of the bond at

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[13] Id. At 197.
[14] 19 U.S.C. § 1337(j)(2)-(4) and 19C.F.R. 210.50(a)(3).
[15] 19 U.S.C. § 1337(j)(3) and 19 C.F.R. 210.50(d).

a level sufficient to "protect the complainant from any injury." [16]

While the investigation was before the ALJ, complainants requested a bond of 100 percent during the Presidential review period. In support of a bond of 100 percent, complainants argued that because most magnets are "made to order" it is difficult to establish a set price differential between imported magnets and magnets manufactured in the United States; that when the Commission does not have adequate evidence on which to establish a rate the bond rate is often set at 100 percent, citing Certain Neodymium-Iron-Boron Magnets, Magnet Alloys, And Articles Containing The Same, Inv. No. 337-TA-372, Comm'n Op. at 15 (Magnets); and that in view of the uncertainty surrounding the precise price differential between imported and domestic magnets, a bond of 100 percent is appropriate. The IAs argued that a bond of 100 percent was set in Magnets in order to protect the complainant from any injury during the Presidential review period; that the circumstances that led to the imposition of a 100 percent bond in the earlier investigation "still exist;" and that, therefore, a bond of 100 percent should be issued in this investigation. ID at 168.

The ALJ found that the evidence in the record was not adequate to establish a bond rate, and therefore recommended a bond in the amount of 100 percent. ID at 169.

We agree with the ALJ and adopt the 100 percent bond recommended by him. Such a bond amount, when there is inadequate price information, is supported by Commission precedent, see, e.g., Magnets at 15; Certain Compact Multipurpose Tools, 337 TA-416, USITC Pub. 3239, Comm. Opinion at 29.

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[16] 19 U.S.C. § 1337(j)(3) and 19 C.F.R. 210.50(a)(3).

PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In the Matter of	)	
	)	
CERTAIN RARE-EARTH	)	Investigation No. 337-TA-413
MAGNETS AND MAGNETIC	)	
MATERIALS AND ARTICLES	)	
CONTAINING THE SAME	)	

Final Initial and Recommended Determinations

Pursuant to the Notice of Investigation (63 Fed. Reg. 47319, 47320), this is the administrative law judge's final initial determination, under Commission rule 210.42. The administrative law judge, after a review of the record developed, finds that a violation of section 337 of the Tariff Act of 1930, as amended (19 U.S.C. § 1337) has occurred.

This is also the administrative law judge's recommended determination on remedy and bonding, pursuant to Commission rule 210.42(a)(1)(ii). The administrative law judge recommends that the Commission issue a general exclusion order as well as cease and desist orders against certain respondents and further recommends a bond of 100% of entered value during Presidential review.

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ABBREVIATIONS

CPost	Complainants' Initial Posthearing Submission
CPostR	Complainants' Reply Brief
CFF	Complainants' Proposed Finding of Fact
CRNFF	Complainants' Rebuttal to NEOCO's Proposed Finding of Fact
CONFF	Complainants' Objection to NEOCO's Proposed Finding of Fact
COSFF	Complainants' Objection to Staff's Proposed Finding of Fact
CRSFF	Complainants' Rebuttal to Staff's Proposed Finding of Fact
NPost	NEOCO's Initial Posthearing Submission
NPostR	NEOCO's Reply Brief
NFF	NEOCO's Proposed Finding of Fact
ROFF	NEOCO's Objection to Finding of Fact
RRFF	NEOCO's Rebuttal Finding of Fact
RROCFF	NEOCO's Objections to Complainants' Proposed Finding
SPost	Staff's Initial Posthearing Submission
SFF	Staff's Finding of Fact
SPostR	Staff's Reply Brief
SONFF	Staff's Objection to NEOCO's Finding of Fact
SRNFF	Staff's Rebuttal to NEOCO's Finding of Fact
SOCFF	Staff's Objection to Complainants' Finding of Fact
SRCFF	Staff's Rebuttal to Complainants' Finding of Fact

Tr. Transcript of Prehearing Conference, Hearing and Closing Arguments

OPINION

I. Procedural History

By notice of investigation, which issued on August 31, 1998 and was published in the Federal Register on September 4, 1998 (63 Fed. Reg. 47319, 47320), the Commission instituted an investigation, pursuant to subsection (b) of section 337 of the Tariff Act of 1930, as amended, to determine whether there is a violation of subsection (a)(1)(B) of section 337 in the importation into the United States, the sale for importation, or the sale within the United States after importation of certain rare-earth magnets or magnetic materials, or articles containing the same, that infringe claims 1, 4, 5, 8, 9 or 11 of U.S. Letters Patent No. 4,851,058, (the '058 patent), claims 1-6, 10, 14-16, or 18-20 of U.S. Letters Patent No. 4,802,931 (the '931 patent), claims 13-18 of U.S. Letters Patent No. 4,496,395 (the '395 patent), claims 1-9, 12-20, 23-27, or 29-34 of U.S. Letters Patent No. 4,770,723 (the '723 patent), claims 1-6, 8-10, 13-19, 21-24, 27-35, or 37-39 of U.S. Letters Patent No. 4,792,368 (the '368 patent), or claims 1-3, 5, 15, 18, 19, 21, or 22 of U.S. Patent Letters No. 5,645,651 (the '651 patent), and whether there exists an industry in the United States as required by subsection (a)(2) of section 337.

Order No. 59, dated August 24, 1999, granted complainants' Motion No. 413-57 to withdraw from the investigation claims 1, 12, 23, 29, 30 and 32 of the '723 patent and claims 1, 13, 14, 22, 27, 32, 33, 34 and 39 of the '368 patent. Hence the claims in issue of the '723 patent and '368 patent are claims 2-9, 13-20, 24-27, 31, 33 and 34 of the '723 patent and claims 2-6, 8-10, 15-19, 21, 23, 24, 28-31, 35, 37 and 38 of the '368 patent.

The complaint was filed on July 31, 1998, under section 337 of the Tariff Act of 1930, as amended, on behalf of Magnequench International, Inc. (Magnequench) of Indiana and

Sumitomo Special Metals Co., Ltd. (SSMC) of Japan.[1]

The respondents, identified in the notice of investigation, are Houghes International, Inc. (Houghes) of New York, International Magna Products, Inc. (IMI) of Indiana, Multi-Trend International Corp. a/k/a MTI-Modern Technology Inc. (Multi-Trend) of California, American Union Group, Inc. (AUG) of Maryland, High End Metals Corp. (High End) of Taiwan, Harvard Industrial America Inc. (Harvard) of California, H.T.I.E., Inc. (H.T.I.E.) of Pennsylvania and CYNNY Magnets (CYNNY) of New Jersey.

Order No. 4, which issued on September 22, 1998 set a target date of September 7, 1999.

Order No. 21, which issued on December 10, 1998, was an initial determination granting complainants' Motion No. 413-14 to amend the complaint and notice of investigation to add A.R.E., Inc. (A.R.E.) of Pennsylvania, NEOCO, L.C. (NEOCO) of Michigan, Beijing Jing Ma Permanent Magnets Materials Factory (Jing Ma) of China and Xin Huan Technology Development Co., Ltd. (Xin Huan) of China. The Commission determined not to review Order No. 21 on January 11, 1999.

Order No. 22, which issued on December 10, 1998, set a new target date of November 8, 1999.

Order No. 24, which issued January 7, 1999, was an initial determination terminating the investigation as to respondent IMI on the basis of a consent order. The Commission, on

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[1] The '395, '058, '931, '723, '368 and '651 patents in issue are collectively referred to herein as the "Magnet Patents." Moreover the '395, '058 and '951 patents are referred to as the "Magnequench Patents" while the '723, '368 and '651 patents are referred to as the "SSMC Patents."

February 1, determined not to review Order No. 24.

Order Nos. 25 and 26 were initial determinations terminating the investigation as to respondents AUG and CYNNY (Order No. 25) and as to respondents H.T.I.E. and Houghes (Order No. 26) on the basis of consent orders. On February 9, the Commission determined not to review said orders.

Order No. 30, which issued on March 4, 1999, set a new target date of December 8.

Order No. 38, which issued on April 29, 1999, was an initial determination granting complainants' Motion No. 413-36 for partial summary determination on the importation issue. The Commission, on May 25, determined not to review Order No. 38.

Order No. 39, which issued on May 3, 1999, was an initial determination granting complainants' Motion No. 413-39 for summary determination on each of the economic prong and the technical prong relating to the domestic industry issue. On May 28, the Commission determined not to review Order No. 39.

By letter dated May 11, 1999 to the administrative law judge, counsel for High End and Harvard represented:

> Neither High End, nor Harvard, will be actively participating in the pre-hearing conference and hearing scheduled for June 9 - 18, 1999. Neither will be calling witnesses or expert witnesses at the hearing. Neither High End, Harvard, nor their counsel will be attending the hearing itself.

Order No. 56, which issued on June 29, 1999, was an initial determination granting complainants' Motion No. 413-47 to the extent that each of respondents A.R.E., Jing Ma and Xin Huan were found in default, pursuant to Commission rule 210.16 and hence held that each had waived its right to appear, to be served with documents, and to contest the allegations at issue in this investigation. On August 6, the Commission determined not to review Order No. 56.

Order No. 60, which issued on August 26, 1999 was an initial determination granting complainants' Motion No. 413-47 to the extent that respondent Multi-Trend was found in default, pursuant to Commission rule 210.16, and hence held that Multi-Trend had waived its right to appear, to be served with documents, and to contest the allegations at issue in this investigation.

The prehearing conference and hearing were conducted on June 9 to 18, 1999. Complainants, respondent NEOCO and the staff appeared at the hearing. Following the filing of post-hearing submissions, closing arguments were heard on July 27, 1999.

The matter is now ready for a decision.

The "Final Initial and Recommended Determinations" are based on the record compiled at the hearing and closing arguments as well as the exhibits admitted into evidence. The administrative law judge has also taken into account his observation of the witnesses who appeared before him during the hearing. Proposed findings submitted by the parties not herein adopted, in the form submitted or in substance, are rejected as either not supported by the evidence or as involving immaterial matter and/or as irrelevant. The findings of fact included herein have references to support evidence in the record. Such references are intended to serve as guides to the testimony and exhibits supporting the findings of fact. They do not necessarily represent complete summaries of the evidence supporting said findings.

II. Parties

See FF 1 to 14.

III. Claim Interpretation

The terms of a claim are given their ordinary and customary meaning in the art, unless it is apparent that the patent applicant, acting as his or her own lexicographer, used the terms in a manner that departed from their ordinary meaning in the art. The terms are construed by considering the claims themselves, the specification, and the prosecution history (intrinsic evidence). Extrinsic evidence, such as testimony of experts, may also be considered. See Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582-83, 39 U.S.P.Q.2d 1573, 1576-77 (Fed. Cir. 1996). (Vitronics).

With respect to many of the terms used in the Magnet Patents, their meanings, as set forth in FF 221 to 240, are not in dispute by the parties participating at the hearing as shown by their post hearing submissions, viz., responses to proposed findings. In dispute however, relative to issues to be determined, are the following:

A. The terms "hard magnet" and "magnetically hard alloy"

NEOCO argued, without specific citation to the evidentiary record, that the phrases in issue are understood by persons of ordinary skill in the art[2] to include magnets with coercivities of a few hundred Oersteds or more. (RRFF at 22). However each of the '058 and '931 patents has the language:

> The terms "hard magnet" and magnetically hard alloy" herein refer to compositions having intrinsic coercivities of at least about

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[2] See FF 272 for whom such a person is.

> 1,000 Oersteds" (CX-1, col. 4, lines 13-15; CX-2, col. 7, lines 7-10).

Thus with respect to the claimed subject matter in issue of the '058 and '931 patents, the terms will be so interpreted in the absence of the Oersteds being specified in the claims.[3]

B. Rare earth elements

There is no dispute that the "rare-earth elements" include neodymium, praseodymium, lanthanum, cerium, terbium, dysprosium, holmium, erbium, europium, samarium, gadolinium, promethium, thulium, ytterbium, and lutetium, and that neodymium and praseodymium are among the "light" rare-earth elements. NEOCO argued that there is no consensus regarding the number of rare-earth elements as yttrium is not always considered a rare earth element. (RRFF at 26). However each of the '058 and '931 patents disclose that the rare earth elements include scandium and yttrium in Group III A of the periodic table and the elements from atomic number 57 (lanthanum) through 71 (lutetium). (CX-1, col. 2, lines 15-19; CX-2, col. 2, lines 14-17). Also each of the '368, '723 and '651 patents include yttrium as a rare earth metal. (CX-4, col. 2, lines 60; CX-5, col. 2, line 67, CX-6, col. 7, 50). Hence the term "rare earth element" will be so interpreted unless the claimed subject matter defines the rare earth element.

C. The term "crystalline R(Fe, Co) BXAM compound" (claims in issue of the '651 patent)

The staff argued that the expression "crystalline R(Fe, Co) BXAM compound" of independent claim 1 is limited to a compound wherein the R, Fe and/or Co, B, X, A and M elements must <u>all</u> exist in the <u>same</u> or <u>one</u> crystalline phase (SPost at 49, Tr. at 2110); and that

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[3] Said terms do not appear in any of the claims in issue of the other Magnet Patents.

independent claim 1 of the '651 patent refers to "compound" not to "magnet." (Tr. at 2122). It is argued that it is unclear from the patent specification of the '651 patent why the patent claims a compound rather than a "material or permanent magnet" and that the term "compound" is not defined in the specification and, in fact, "never appears in the specification." (SPost at 46).[4] The staff argued that in the prosecution of the '651 patent applicants drew a distinction between "alloy" and "compound" and relied on that distinction to avoid the Examiner's rejection of the asserted claims (Tr. at 2302 to 2304);[5] that Grant & Hackh's Chemical Dictionary 25, 148, 306 (5th ed. 1987) distinguishes "intermetallic compound," "compound" and "alloy"; and that complainants' expert Guruswamy equated the term "phase" with the term "compound."[6] (SPost at 47 to 49).

Complainants' position is that neither NEOCO nor the experts testifying at the hearing

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[4] The words "compound" or "compounds" appear repeatedly in the specification of the '651 patent. See, e.g.., col. 23, line 66, 67.

[5] The rejected claims did recite a "crystalline Re(Fe,Co)BXAM compound" (FF 217) and hence there was no amendment made to the rejected claims with respect to the terms "compound" and "alloy." However following the Examiner's rejection on indefiniteness it was represented by applicants that "all of the claims are directed to crystalline compounds of a stable tetragonal structure and are not alloy claims." (FF 219).

[6] The staff made reference (SPost at 48) to the following testimony of Guruswamy who when asked to interpret the '931 patent, which recites a magnet that has as a predominant 2-14-1 phase, replied:

> the most important element of the different claims [of the '931 patent] is the presence of a 2-14-1 phase in the magnet, with the particular crystal structure. . . This particular patent identifies a particular specific compound which has a particular crystal structure that should be present in the alloy, whereas the '058 patent does not specify such a compound, does not require the presence of such a compound." [Tr. at 354].

ever raised the issue as to the meaning of the claimed term "crystalline R(Fe,Co)BXAM compound" (CPostR at 23) and that the claimed term should be interpreted as covering multiple phases. (Tr. at 2132). In support, complainants rely on the language of the specification of the '651 patent and the testimony of experts. (Tr. at 2134 to 2138; CPostR at 18 to 22). The staff in turn argued that complainants' expert James makes the point that one simply cannot assume that all of the elements existing in an alloy or magnet exist together in a single phase and that complainants' Guruswamy and NEOCO's Bohlmann apparently based their testimony upon an incorrect interpretation of the '651 patent. (SPostR at 12 to 15). The staff also, referring, for example, to the portion of the '651 patent that reads:

> It is believed that the magnetic materials and permanent magnets based on the Fe-Co-B-R base alloys according to the present invention can satisfactory exhibit their own magnetic properties due to the fact that the <u>major phase</u> is formed by the substantially tetragonal crystals of the Fe-B-R type. [FF 136] [Emphasis added]

argued that only the "major phase" therein is the crystalline compound called for by independent claim 1 and the dependent claims in issue. (Tr. at 2126).

The administrative law judge can find no specific language in independent claim 1 of the '651 patent or in the specification of the '651 patent that requires that the "R(Fe,Co)BXAM" elements of the claimed phrase "crystalline R(Fe,Co)BXAM compound" exist in a single phase. The parties appear not to dispute the lack of such specific language. Moreover the parties appear not to dispute that the term "compound" is not defined in the '651 patent. In the prosecution of the '651 patent, applicants did represent that the claims of the '651 patent are directed to compounds, not an alloy and thus distinguished a compound from an alloy. (FF 219). However the administrative law judge can find nothing in the prosecution of said patent to indicate the basis for that distinction, much less the conclusion that the claimed expression "crystalline R(Fe,Co)BXAM compound" is limited to a single phase as the staff argued .[7] The administrative law judge does find that allowance of the claimed subject matter was predicated on the fact that the claimed compound has a tetragonal crystal structure having certain lattice contants and not because the claimed "crystalline R(Fe,Co)BXAM compound" exists in a single phase or because of any range of the specified R(Fe,Co)BXAM elements. (See FF 218).

The administrative law judge moreover finds that the specification of the '651 patent discloses that the claimed compound can contain a plurality of phases, viz., nonmagnetic phases in a volume ratio between 1 and 45 vol. % (see FF 137); that the claimed compound can have the addition of the M element (see FF 137); and that the claimed compound can contain up to 1 % of the A element: H, Li, Na, K, Be, Sr, Ba, Ag, Zn, N, Se, Te and Pb. (See FF 137). Moreover according to the patentees of the '651 patent their invention can be further explained with an example (CX-6, col. 25, lines 14-15) which reads in part (CX-6, col. 25, lines 24-34):

> X-ray diffraction has indicated that the major phase of the

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[7] There is expert testimony that an "alloy" can be analogous to a "compound" in chemistry in that two metal elements react together to form an alloy or a new compound (FF 322) and that in an alloy there is an atomic mixture between two elements in question which "can result in solid solution, compound formation" (FF 322). In the experimental section of an article titled "Magnetic Properties of Rare-Earth-Iron Intermetallic Compounds" by K. Strnat, G. Hoffer and A.E. Ray IEEE Transaction On Magnetics at 489-493 (September 1966) (CX-18, Tab 43), which relates to compounds as the title indicates, there is also reference to single-phase microstructure and a two phase structure.

> sintered body is a tetragonal system compound with lattice constants a_o=8.79 Å and c_o=12.21 Å. As a consequence of XMA and optical microscopy, it has been found that the major phase contains simultaneously Fe, Co, B and Pr, which amount to 90 volume % thereof. Nonmagnetic compound phases having a R content of no less than 80% assumed 4.5% in the overall with the remainder being substantially oxides and pores. The mean crystal grain size was 3.1 μm.[[8]] [Emphasis added]

It is further disclosed in the specification that practically useful magnetic properties are obtained if the "mean crystal grain size of the intermetallic compound is in a range of about 1 to about 100 μm for both the Fe-Co-B-R and Fe-Co-B-R-M systems (CX-6, col. 3, line 67, col. 4, lines 1-31) (Emphasis added); that a FIG. 13 shows the relationship "between the amount of Cu, C, P and S" (the claimed X elements) and Br of one embodiment of the invention (CX-6, col. 4, lines 60-62); and that the term "major phase" is intended to indicate "a phase amounting to 50 vol % or more of the crystal structure, among phases constituting the crystal structure." (FF 136) (Emphasis added).

Based on the specification of the '651 patent the administrative law judge finds that one of ordinary skill in the art would not limit the claimed term "crystalline R(Fe,Co)BXAM compound" and the recited "R(Fe,Co)BXAM" elements of independent claim 1 to a single

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[8] The staff argued with respect to this example that sodium (Na) is one of the claimed "A" elements and it is notable that the inventors did not report finding any such elements, such as Na, in the predominant phase of the magnet and thus the magnet contained Na, but the magnet's predominant or major phase, or "compound" did not. (SPostR at 10). If the staff's argument is accepted, the example at column 25, which the inventors have characterized as explaining the invention, would not read on independent claim 1 and all of the other claims of the '651 patent, which are dependent on claim 1. Moreover the administrative law judge is unable to find any disclosure in the '651 patent wherein the inventors identified each of the claimed "R(Fe,Co)BXAM" elements in a "major phase." There is however no allegation by any party that the claimed subject matter of the '651 patent is invalid under 35 U.S.C. §112.

phase.

Extrinsic evidence, such as expert testimony, may be considered in determining the meaning and scope of technical terms in a claim. See Vitronics, 90 F.3d at 1584, 39 U.S.P.Q.2d at 1578. Also claims are construed in the same manner when determining both validity and infringement. W.L. Gore & Associates, Inc. Garlock, Inc., 842 F.2d 1275, 1279, 6 USPQ2d 1277, 1280 (Fed. Cir. 1988). In addition the construction of the meaning of language in a claim should be made independent of what is being alleged to infringe the claim. See DONALD S. CHISUM, Patents §1803 (1994). While the staff relies on expert testimony of complainants' expert Guruswamy with respect to testimony regarding the '931 and '723 patents (SPost at 48) and complainants rely on the testimony of Guruswamy and NEOCO's expert Bohlmann (CPostR at 18 to 22) which testimony the staff argued was based on an "incorrect interpretation" of the '651 patent (SPostR at 15), the administrative law judge can find no testimony from any expert, based on the intrinsic evidence relating to the '651 patent and independent of any infringement issues, as to how a man of ordinary skill in the art would interpret the claimed term "crystalline R(Fe,Co)BXAM compound" of the '651 patent and whether it would be interpreted such that said compound is limited to a single phase.

In recent weeks and after closing arguments on July 27, 1999 this administrative law judge has been puzzled by the fact that the staff, who argued that "probably better evidence of the meaning of the term 'compound' [of independent 1 of the '651 patent] comes from Dr. Guruswamy" (SPost at 48), nor any other party had questioned an expert at the hearing as to how one of ordinary skill in the art would interpret the claimed term "crystalline R(Fe,Co)BXAM compound" of the '651 patent based solely on the language of the claims, the specification and prosecution of the '651 patent. On August 27 the administrative law judge reviewed again the prehearing statement of the staff dated June 7. Since then he also has reviewed the record in this investigation which was instituted more than a year ago. Based on the staff's prehearing statement and the record in this investigation it appears that the reason why counsel for complainants nor counsel for NEOCO at the hearing did not interrogate a witness as to the meaning of the claimed term "crystalline R(Fe,Co)BXAM compound" was because they were not put on notice with respect to the staff's position until the staff filed its initial post hearing submission on July 13 which was <u>after</u> the hearing and <u>after</u> the record in this investigation had been closed. Significantly, while the staff in its posthearing submissions has taken the position that no asserted claim of the '651 patent is infringed, the staff in its prehearing statement at 2 had taken the position that the "evidence is expected to show that <u>one or more claims of the asserted patents</u> is infringed by one or more of the accused magnets of the Respondents." (Emphasis added). Moreover the staff at 13-14 of its prehearing statement represented that respondent NEOCO does not dispute the interpretation of terms used in the claims at issue as set forth by complainants' technical witnesses in their expert reports. Thereafter the staff set out complainants' experts' definitions of certain of the "pertinent" terms which definitions the staff appears to adopt in its prehearing statement. Missing from the terms set out by the staff, in its prehearing statement, is the claimed term "crystalline R(Fe,Co)BXAM compound" of the '651 patent although an understanding of that term is crucial to the infringement issues involving the '651 patent.

At the prehearing conference on June 9, 1999 this administrative law judge made reference to the definitions of certain terms by the staff in its prehearing statement. He further put the parties on notice that claim construction is critical to the issues in the case; that the administrative law judge will have to first construe the language of the claims without even considering what is alleged to be infringed; and that the parties in presenting the case better make it clear as to what claimed terms are in dispute. (Tr at 46-47). He also expressed concern about complainants' allegation at page 17 of their prehearing statement that respondents' magnets infringe "at least one and often more of the asserted claims of the patents in issue"[9] and about the staff's allegation at page 32 of its prehearing statement that the accused products infringe "some" of the patent claims in issue. (Tr at 49-50).[10] In this investigation not only has the staff in its posthearing submission reversed its position as to infringement of the '651 patent after the hearing was concluded and after the record has been

[9] The complainants after the hearing withdrew some of the claims in issue. See Order No. 59.

[10] Referring to the ground rules that are in effect in this investigation, ground rule 8 which relates to the contents of a prehearing statement requires that the statement contain, inter alia:

> (d) A statement of the issues to be considered at the hearing that sets forth with particularity a party's contentions on each of the proposed issues, including citations to legal authorities in support thereof. Any contentions not set forth in detail as required herein shall be deemed abandoned, or withdrawn, except for contentions of which a party is not aware and could not be aware in the exercise of reasonable diligence at the time of filing the prehearing statements. Pursuant to this requirement, each of the parties and the staff shall take a position on the issues it is asserting no later than the filing of its prehearing statement.

(Emphasis in original). As ground rule 8 states, a party may in its posthearing submission refer to contentions not set out in its prehearing statement but only when it is established by the party that it was not aware, and could not be aware in the exercise of reasonable diligence, at the time of filing of its prehearing statement, of those new contentions.

closed but appears to have raised for the first time a Markman claim interpretation issue.[11] There is abundant case law that such an issue should be developed, and all parties put on notice of such an issue, before any trial takes place or at least during the trial itself, so all parties will have the opportunity to present testimony on the issue. The language of the '651 patent did not change since the investigation was instituted almost a year ago. Thus the staff had notice of the "major phase" recitation in the '651 patent. However the administrative law judge is unable to find any discovery in which the staff pursued the issue as to whether the claimed "crystalline R(Fe,Co)BXAM compound" of the '651 patent should be interpreted such that it is limited to a "major phase."[12]

The target date in this investigation is December 8, 1999 as set by Order No. 30. Under Commission rules the administrative law judge could issue an initial determination[13] extending the target date, reopen the record, readjourn the hearing and obtain testimony of experts, regarding the Markman issue raised by the staff in its posthearing submission. However extrinsic evidence is not a requirement for claim interpretation. Thus, as the Court stated in Vitronics 39 U.S.P.Q.2d at 1578, it is only when there is still some genuine ambiguity in the claims "after consideration of all available intrinsic evidence" should a trial

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[11] See Markman v. Westview Instr., Inc., 52 F.3d 967, 34 U.S.P.Q.2d 1321 (Fed. Cir. 1995), aff'd, 517 U.S. 370, 38 U.S.P.Q.2d 1461, 38 U.S.P.Q.2d 1461 (1996).

[12] The staff in interrogatories dated November 3, 1998 to complainant SSMC did ask for the identity of any tests etc. as to whether the accused magnets imported by any respondent infringe the patents in issue. See Int. No. 23. Hence the staff was apparently aware of the test data relied on by SSMC to support its infringement allegations as to the asserted claims of the '651 patent but yet appear not to have questioned the data as to how it infringes said claims.

[13] As the procedural history shows, any further extension of the target date has to be done through an initial determination.

court resort to extrinsic evidence, such as expert testimony, to construe a claim. With respect to the Markman issue in question the administrative law judge finds expert testimony unnecessary for interpretation of the claimed term "crystalline R(Fe,Co)BXAM compound" of the '651 patent in view of the specific reason why the Examiner allowed the claims of the '651 patent[14] and in view of the specification of said patent. Hence he is not extending the target date.

IV. Validity (Prior Art)

Under 35 U.S.C. §102 a patent may not be valid by anticipation. However a claim is invalid as anticipated only if a single prior art reference expressly or inherently discloses each and every element of the claimed invention. See In re Robertson, 169 F.3d 743, 745; 49 U.S.P.Q.2d 1949, 1950 (Fed. Cir. 1999). If a reference fails to disclose even a single claimed element, a finding of anticipation is improper. See Atlas Powder Co. v. E.I. DuPont de Nemours & Co., 750 F.2d 1569, 1574; 224 U.S.P.Q. 409, 411 (Fed. Cir. 1984). Thus, a party asserting that a patent claim is anticipated must show identity of invention. See Minnesota Mining & Mfg. Co. v. Johnson & Johnson Orthopaedics, Inc., 976 F.2d 1559, 1565; 24 U.S.P.Q.2d 1321, 1326 (Fed. Cir. 1992) (Minnesota Mining).

An anticipatory reference must also enable a person of ordinary skill in the art to make the claimed subject matter at the time of the invention without undue experimentation. See PPG Indus., Inc. v. Guardian Indus. Corp., 75 F.3d 1558, 1566; 37 U.S.P.Q.2d 1618, 1624 (Fed. Cir. 1996); Minnesota Mining, 976 F.2d at 1572; 24 U.S.P.Q.2d at 1332. In order for

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[14] See FF 218.

a description to be sufficient it must be in clear and exact terms, and describe the invention with enough specificity to enable a person skilled in the relevant field to practice the invention. Canron, Inc. v. Plasser Am. Corp., 474 F. Supp. 1010, 1013; 203 U.S.P.Q. 440, 444 (E.D. Va. 1978), aff'd, 609 F.2d 1075 (4th Cir. 1979), cert denied, 446 U.S. 965 (1980). Therefore, a prior art reference does not anticipate if it would require a person skilled in the art to engage in undue experimentation to practice the claimed invention. See Minnesota Mining, 976 F.2d at 1572; 24 U.S.P.Q.2d at 1332.

In addition, a reference that discloses a genus or generic group but does not disclose a species or specific member of that group does not anticipate a claim to the species. See Corning Glass Works v. Sumitomo Elec. U.S.A., Inc., 868 F.2d 1251, 1262; 9 U.S.P.Q.2d 1962, 1970 (Fed. Cir. 1989). Even if the claimed invention is subsumed in a reference's generalized disclosure, if there is no literal identity of invention, that reference does not anticipate the claimed invention. See Minnesota Mining, 976 F.2d at 1572; 24 U.S.P.Q.2d at 1332.

A patent is invalid under 35 U.S.C. § 103 if:

> the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

Id. The test for obviousness requires four factual determinations, viz., (1) the scope and content of the prior art; (2) the differences between the prior art and the claims at issue; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness, such as commercial success, copying, or long-felt need. Graham v. John Deere Co., 383 U.S. 1, 17,

(1966) (Graham).

In analyzing invalidity under 35 U.S.C. § 103, "the changes from the prior art . . . must be evaluated in terms of the whole invention, including whether the prior art provides any teaching or suggestion to one of ordinary skill in the art to make the changes that would produced the patentee's . . . device." Northern Telecom Inc. v. Datapoint Corp., 908 F.2d 931, 935 (Fed. Cir.), cert. denied, 498 U.S. 920 (1990). The burden of establishing the invalidity of patent claims "is especially difficult when the prior art was before the PTO examiner during prosecution of the application." Hewlett-Packard Co. v. Bausch & Lomb, Inc., 15 U.S.P.Q.2d 1525 1527 (Fed. Cir. 1990), citing American Hoist & Derrick Co. v. Sowa & Sons, Inc., 725 F.2d 1350, 1359 (Fed. Cir.), cert. denied, 469 U.S. 821 (1984).

A. Magnequench Patents

NEOCO argued that the "Magnequench patents" are invalid under 35 U.S.C. §102 since Norman C. Koon invented the pioneer RE-Fe-B composition first. (NPost at 40-41).[15] It is argued that the significance of a Koon presentation in the fall of 1980, at a MMM conference (Twenty Sixth Annual Conference on Magnetism and Magestic Materials) in Dallas, Texas (the MMM 1980 conference) entitled "A New Class of Melt Quenched Amorphous Alloys," was that Koon reported achieving superior magnetic properties from rare-earth-iron ternary alloys that included boron. (NPost at 20). NEOCO referenced Interference No. 103,182 entitled Croat v. Koon involving John J. Croat's '058 and '931 patents and a Koon reissue application of Koon U.S. Patent No. 4,402,770 (the '770 patent), and the fact

[15] NEOCO termed the '395 patent in issue the first Magnequench patent. (NPost at 27).

that Koon was designated in the interference notice the senior party while Croat was designated the junior party. (NPost at 23).

NEOCO further argued that all of the asserted claims of the '058 patent are anticipated under 35 U.S.C. § 102 and obvious under 35 U.S.C. § 103. In support NEOCO relied on a Koon and Das article titled "Magnetic Properties of Amorphous and Crystallized $(Fe_{0.82}B_{0.18})_{0.9}Tb_{.0.05}La_{.0.05}$'," Appl. Phys. Lett. 39 (10) November 1981 (the Koon article) (RXN-56) (NPost at 47). It is also argued that certain claims of the '058 patent are "obvious under 35 U.S.C. § 103 in view of the '395 patent." (NPost at 47). Koon alternatively argued that both a Koon November 1980 abstract, viz., Koon, Williams and Das, Abstract: A new class of melt quenched magnet alloy Appl. Phys. Lett. 39 at 840 (1981) (RXN-18) (the Koon 1980 abstract) (RXN-51) and a Koon March 1981 abstract, viz., Koon, Williams and Das, Abstract: A new class of melt quenched amorphous magnetic alloys. J. Appl. Phys. 52(3), March 1981 (the Koon 1981 abstract) (RXN-18) with the '395 patent makes claim 9 of the '058 patent obvious when taken with the Koon article. (NPost at 47, 48). NEOCO further argued that "Koon's patents" anticipate the Magnequench '931 patent, with 20 claims and the '058 patent with 11 claims. (NPost at 52).

NEOCO also argued that an article by Drozzina et al., entitled "A New Magnetical Alloy With Very Large Coercitive Force," Nature, Vol. CXXXV, p. 36-37 (1935) (the Drozzina article) (RXN-30), which a 1959 Bozorth reference mentions (FF 321), refers to iron neodymium compositions with high coercivities, and also suggests the presence of a uniform phase; that an article by Shirk et al., entitled "Theoretical and Experimental Aspects of Coercivity Versus Particle Size for Barium Ferrite", published in the IEEE Transactions on

Magnetics journal in September 1971 (the Shirk article) (RXN-13), describes a search for uniform fine particles and suggests a correlation between particle size and coercivity which "also" casts doubt on the validity of the'395 patent and its progeny; that an Ostertag U.S. Patent No. 3,421,889 (the '889 patent) (RXN-10) teaches that rare earths in combination with iron may have preferred magnetic properties; and that a Nesbitt U.S. Patent No. 3,560,200 (the '200 patent) (CX-447) is significant as it represents a ternary alloy with permanent magnetic quantities developed by rapid quenching. (NPost at 38, 39). At the hearing NEOCO's position was that the '395 patent is invalid in view of (1) U.S. Patent No. 3,615,911 to Nesbitt (the '911 patent) (CX-448); (2) the '200 patent; (3) the Shirk article; (4) the '889 patent; and (5) the Drozzina article. (Bohlmann, Tr. at 1339-47, 1359-66, 1434-41, and 1453-1526; RXN-95, Qs. 20-24; CX-422, Q. 45; CX-447; CX-448; RXN-13; RXN-10, RXN-30).

Each of complainants and the staff argued that NEOCO has not established by clear and convincing evidence that the asserted claims of the Magnequench patents are invalid.

1. '058 Patent

Each of the asserted independent claims 1, 4, 5, 8, 9 and 11 in issue of the '058 patent, which is based on a patent application filed Sept. 3, 1982 (FF 32), is directed to a magnetically had alloy composition (claims 1, 4, 5, 9 and 11) or a hard magnet (claim 8) that must contain: (1) at least about 10 atomic percent of neodymium and/or praseodymium or mixtures thereof;[16] (2) at least about 50 atomic percent iron; and (3) at least about 0.5 atomic

[16] The '058 patent discloses that neodymium and praseodymium are among the most abundant and least expensive of the rare earths. (CX-1, col. 5, lines 46-48).

percent boron. (FF 41 to 46, RX 440, Q&A 14). Each of the twenty-one (21) examples and Figures of the '058 patent relate to compositions of (1) neodymium or praseodymium (2) iron and (3) boron (FF 38) which applicant in the specification teaches is the particularly preferred composition. (FF 34). In the prosecution of the claims that led to the claims in issue of the '058 patent (FF 156), while the Examiner was aware of the Koon 1981 article (FF 157), he rejected none of the claims in issue on that prior art. Rather in an Office Action dated 2/20/85 he rejected claims, which ultimately resulted in claims in issue, as anticipated by, or obvious over, Koon U.S. Patent No. 4,402,770 on the ground that Koon teaches a magnetically hard alloy containing a rare earth element selected from Ce, Pr, Nd and mixtures thereof, La, B and Fe, Co and/or Ni. (FF 157). Applicant responded as follows (FF 158):

> Claims 21, 26, 30 and 31 have been rejected as anticipated under 35 U.S.C. 102(a) or obvious under 35 U.S.C. 103 in view of U.S. patent 4,402,770 to Koon. <u>These claims have been amended to specifically require at least 10 atomic percent of neodymium and/or praseodymium</u>. Koon specifically states that the non-preferred lanthanides include neodymium and praseodymium and that these rare earths <u>must not be present in concentrations more than 2 atomic percent</u> (Koon '770, column 2, lines 46-50). Therefore, claims 21, 26, 30 and 31 are well outside the compositional ranges of Koon '770. Koon teaches away from using more than 2 percent Nd and/or Pr to make permanent magnets. [Emphasis added]

Thereafter in the prosecution of the '058 patent the Examiner dropped his rejection on the Koon '770 patent. (FF 160, 161, 162, 164, 165). In an amendment dated April 6, 1987 applicant commented on the claimed percentages as follows (FF 168):

> It is recalled that Dr. Croat discovered that iron-neodymium and iron-praseodymium based compositions could be rapidly solidified to form products having permanent magnet properties. That discovery was disclosed and claimed in his U.S. Patent No.

4,496,395. The subject application describes and claims improved compositions that incorporate boron. The addition of boron to iron-neodymium alloys, for example, provides a substantial increase in magnetic properties such as coercivity and Curie temperature. In the experience reflected in the many examples presented in the subject application, the preferred addition of boron to iron and neodymium or praseodymium based compositions is such that boron makes up about 0.5 to 10 atomic percent of the total composition. Particularly desirable permanent magnetic properties were observed in such mixtures described in the working examples of this application. However, there is no suggestion in the application and indeed no technical basis for concluding from its teaching that higher boron additions are unsuitable for achieving improvements in magnetic properties in iron-neodymium-praseodymium based compositions. To the contrary, in the brief summary portion of the specification at pages 3 and 4, it is stated with reference to the basic formula $RE_{1-x}(TM_{1-y}B_y)_x$ that the value of x is preferably in the range of about 0.5 to about 0.9 and y is preferably in the range of about 0.01 to about 0.20. Accordingly, in this disclosure of a preferred practice of the invention, the boron content could be at least about 18 atomic percent of the overall basic formula. In general, the specification points out benefits of combining boron with iron and neodymium and/or praseodymium. There is no suggestion that boron content in excess of amounts described as preferred so change the magnetic properties of the overall compositions as to be outside the scope of the invention.

Claim 24 [which became claim 4 in issue] (like claims 26, 30 and 32) [which became claim 5, 9 and 11 in issue] is presented in the application to recite the invention in a different form than other claims. Claim 24 requires that a magnetically hard alloy composition be formed and that it contain a specified range of rare earth elements and iron and a minimum amount of boron. However, the claim requires these compositional recitations to cooperate such that the resultant material has an intrinsic magnetic coercivity of at least 5,000 Oersteds at room temperature. Claims 26, 30 and 32 recite the inventions in like terms. They provide compositional ranges for two of the necessary constituent element types, they provide a minimum amount of the third necessary constituent, boron, and they require that the overall material cooperate to provide certain minimum permanent magnet properties. The law does not

> require applicant's claims to provide a detailed recipe of his permanent magnets. The law requires the claims to distinctly claim the invention. It is respectfully submitted that claims 24, 26, 30 an 32 accomplish this requirement and satisfy 35 USC 112. [Emphasis added]

The Examiner on Feb. 3, 1989 allowed the claims in issue and the '058 patent issued on July 25, 1989. (CX-17, Tab 41, CX-1).

As the prosecution of the '058 patent makes clear, allowance of the claimed subject matter in issue was predicated on the claimed compositions requiring specified ranges of neodymium and/or praseodymium and iron and a minimum amount of boron to provide a magnetically hard alloy composition which in some of the claims in issue have certain minimum permanent magnet properties. (See FF 156 to 172).

2. '395 Patent

Each of the asserted independent claims 13, 14, 15, 16, 17 and 18 of the '395 patent in issue, which is based on an application filed June 16, 1981 and which issued on January 29, 1985 (FF 19), is directed to a permanent magnet alloy (claim 13) or a permanent magnet (claims 14, 15, 16, 17 and 18) having an inherent intrinsic coercivity of at least 5,000 Oersteds at room temperatures and containing (1) neodymium and/or praseodymium and iron alloys. (FF 26 to 31). In the prosecution of the '395 patent the claims, which ultimately resulted in the claims in issue, were not included in the application until September 26, 1983 and March 5, 1984. (FF 148). When the claim, which resulted in claim 12,[17] was added on September 12, 1983 it was argued (FF 149):

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[17] Claim 12 recites the rare earth elements taken from the group consisting of neodymium, samarium and praseodymium. (FF 149).

> This invention relates to a new family of rapidly quenched rare earth-iron alloys for permanent magnets which alloys have high intrinsic magnetic coercivities at room and elevated temperatures (up to about 300°C). Before this invention it was widely believed that the light rare earth elements, particularly the light rare earth elements neodymium and praseodymium could not be alloyed with the transition metal element iron to make useful permanent magnets. (See, e.g., the enclosed article "Magnetic Properties of Rare-Earth-Iron Intermetallic Compounds", K. Strnat et al, IEEE Transactions on Magnetics, Vol. Mag-2, No. 3, September 1966, page 492, column 2, first full paragraph). Either magnetic intermetallic phases of light rare earth elements and iron would not form or the phases that would form had unacceptably low Curie temperatures. [Emphasis added]

Applicant, responding to a rejection, argued on Sept. 12, 1983 (FF 149):

> Further, claim 45, [which became claim 12 of the '395 patent] is not obvious in view of Ostertag et al [U.S. Pat. No. 3, 421,889 and which NEOCO relies on in its prior art] because cobalt and iron are nonanalogous alloy constituents in the fabrication of permanent rare earth-iron magnets. As noted in the Strnat et al article, cited above, iron compounds corresponding to known intermetallic cobalt compounds either do not exist or they have such low Curie temperatures that they are impractical. (See also, the compilations of rare earth-transition metal intermetallic compounds in "FERRO-MAGNETIC MATERIALS, A handbook on the properties of magnetically ordered substances, by E.P. Wohlfarth, Vol. 1, page 388 (1980), "Intermetallic Rare-earth Compounds", by K.N.R. Taylor, Advanced Physics, Vol. 20, page 616 (1971), and "Rare Earth Permanent Magnets", by E.A. Nesbitt et al, Academic Press, page 67 (1973). Applicant does not believe that the Nd_6Fe_{23} phase actually exists since repeated attempts to duplicate the compounds were unsuccessful.) The enclosed article from Russian Metallurgy, No. 3, page 50 (1965) includes a Nd-Fe phase diagram that shows that the only identified intermetallic compound of iron and neodymium is Nd_2Fe_{17} which has an unacceptably low Curie temperature. Praseodymium would be expected to have a similar phase diagram.
>
> Thus, Ostertag et al neither anticipates nor suggests Claim 45 because the magnetic phase of applicant's rapidly quenched alloys

> simply would not form if the combined rare earth elements and iron were processed by Ostertag's slow solidification method. [Emphasis added]

Applicant, in remarks filed March 5, 1984, in the prosecution of the '395 patent, argued (FF 150):

> A copy of the recent article "Powerful New Magnet Material Found" which appears in the March 2, 1984 issue of Science magazine is enclosed for the Examiner's information. While GM [General Motors] to which the '395 patent was originally assigned] takes issue with some of the "facts" as they are set out in the Science Article, it is being brought to the PTO's attention because it is indicative of the excitement that has been generated by Dr. Croat's discovery of light rare earth-iron permanent magnets. Because of the obvious significance of this patent application to GM, Claims 47-51 are being added at this time to further clarify and distinctly claim the invention.
>
> The Science article makes note of the work of several others in the fields of rare earth element magnets and metallurgy. It makes particular reference to a 1979 Russian publication of neodymium-iron-boron phase diagrams (Science, p. 921, col. 3, para. 2). A copy of the Russian text and an English translation are also enclosed for the Examiner's information.
>
> While the author of the Science article seems to put great stock in this Russian article, it is not relevant to any rejection of claims in this case because it fails to teach or suggest that rare earth-iron alloys are or could be permanently magnetic. It is not possible to determine or predict the magnetic characteristics of metal alloys by looking at their phase diagrams! Thus a researcher looking for a new magnetic alloy would not have any greater incentive to look at Nd-Fe phase diagrams than at any of thousands of other iron alloy diagrams - - except to explain results that had already been achieved. Before the invention claimed herein, those skilled in the magnetic art did not consider light rare earth-iron alloys to be viable candidates for making permanent magnets. As a further point of information on the Russian article, GM's research indicates that the $R_3Fe_{16}B_1$ phase reported by the Russians does not exist and that it is a stable $R_2Fe_{14}B$ phase (shown in the figure on page 921 of the Science article) that is the primary source of hard magnetism in suitably processed, boron-containing, rare

earth-iron alloys.

> The Science article also mentions the work of Arthur Clark at p. 921, col. 1, par. 2. This work is covered in the Clark article "High Field Magnetization and Coercivity of Amorphous RE-Fe Alloys", Applied Physics Letters, Vol. 23, No. 11, Dec. 1973 which is already of reference in this case.
>
> Work of Norman Koon and Badri Das is also mentioned at p. 921 col. 2 of the Science article. This work is the subject matter of recently issued U.S. Patent Nos. 4,409,043; 4,402,770; 4,375,372 and 4,374,665. These patents are not effective references to this application because they were filed later (October 23, 1981). They are also limited to compositionally different alloys which must contain substantial amounts of boron, lanthanum, heavy rare earth elements and iron but no more than 2% total of the light rare earth elements cerium, neodymium and praseodymium. [Emphasis added]

On December 11, 1984, the Examiner allowed the claims in issue. (FF 156). The '395 patent then issued on Jan. 29, 1985. (FF 155).

As the prosecution of the claims in issue shows, arguments about the wide belief that the light rare earth elements neodymium and praseodymium could not be alloyed with the transition metal element iron to make useful permanent magnets led to the issuance of asserted claims 13, 14, 15, 16, 17 and 18. (See FF 148 to 155). Those claims (FF 26 to 31) are specific to a permanent magnet alloy having an inherent magnetic coercivity of at least 5000 Oersteds at room temperature and comprising the light rare earths neodymium, praseodymium or mischmetals of neodymium and praseodymium[18] as well as iron.

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[18] The '395 patent discloses that mischmetals, in the context of the '395 patent, consist predominantly of rare earth elements. (CX-3, lines 62-63).

3. '931 Patent

Each of the asserted independent claims 1, 2, 3, 10, 14, 16, 18, 19 and 20 and dependent claims 4, 5, 6 and 15 in issue of the '931 patent, which is based on an application filed October 26, 1983 and which issued on February 7, 1989 (FF 47), is directed to a permanent magnet (claims 1, 2, 10, 14, 15), a magnetically hard alloy composition (claims 3, 4, 5, 6) a permanent magnet alloy (claim 14, 15, 19, 20) and a permanent magnet composition (claims 16, 18) having an RE_2, $TM_{14}B$, predominant phase and containing (1) at least about 6 atomic percent neodymium and/or praseodymium (2) at least about 40 atomic percent iron and (3) at least 0.5 atomic percent boron. (FF 53 to 65). The specification of the '931 patent discloses that specific objects of the invention include making high strength magnet alloys from iron, boron and particularly neodymium and praseodymium in suitable proportions to form alloys exhibiting higher intrinsic coercivities and energy products than boron-free alloys. (FF 52). It further teaches that praseodymium and neodymium are preferred as the rare earth elements because of their relative abundance in nature, low cost and inherently higher magnetic moments. (FF 52). Each of the examples of the '931 patent relate to neodymium or praseodymium, iron and boron compositions. (FF 49). While the application on which the '931 patent is based was filed on October 26, 1983 the claims on which the claims in issue ultimately issued did not originate in the application until at least Sept. 9, 1985. (FF 175, 176). In remarks dated September 9, 1985, applicant argued (FF 177):

> Claims 5 and 26-32 have been rejected under 35 USC 102 or 103 over Koon 4,402770. Koon is cited as teaching a permanent magnet alloy which may contain Nd and Pr.
>
> Koon relates to compositions which must contain heavy rare earth

elements, lanthanum, at least one transition metal, boron and an auxiliary glass former such as phosphorous, silicon, aluminum, arsenic, germanium, indium, antimony, tin, or bismuth. Applicant's compositions do not require lanthanum or such glass formers to obtain better magnetic properties than any taught or suggested by Koon. Moreover, Koon prefers the heavy rare earths and cannot tolerate more than 2 percent neodymium and/or praseodymium in his compositions (Col. 2, lines 46-50).

All claims now in the case except claims 73 and 74 [The Examiner in the Office action dated 5/15/86 (CX-20, Tab 12) assumed applicant was referring to claims 62 and 63] require at least about 6 atomic percent Nd and/or Pr. Claims 73 [62] and [63] require more than 2 percent of these elements. Accordingly, all claims are outside the compositional ranges of Koon and are not anticipated nor obviated by the reference.

* * *

Applicant's compositions require more iron than cobalt. They are all based on Nd and/or Pr. They require more boron than most of the alloys claimed by Hitachi would allow. Moreover, the reference teaches that adding iron in an amount of more than about 10 percent of the cobalt reduces the intrinsic magnetic coercivity of sintered alloys (translation, page 2, par. 2, lines 14-17). Figure 11 of the subject application shows that increasing the iron content up to about 87% increases coercivity. Hitachi also teaches that adding boron reduces the Curie temperature (trans., page 3, par. 3). Figure 27 of our application shows that adding boron increases Curie temperature. The fact that iron and boron cause different and documented results in the compositions claimed herein and those taught by Hitachi strongly substantiates the material differences between the two different families of magnetic materials.

Jap. '419, also to Hitachi, relates to "highly magnetostrictive materials of the type used for ultrasonic oscillators" (translation, page 2,lines 1-2). Magnetostricters must have very low coercivities so they can rapidly change polarity with little loss in weak reversing field: that is, they are very soft magnets with low coercivities. This is discussed, for example, at page 5, Col. 1 of a booklet put out by Hitachi Magnetics which was also cited by Applicant in the prosecution of USSN 274,070.

> All claims herein are drawn to permanent magnets with very high coercivities. Therefore, they are not suggested by the magnetically soft alloys of the '419 reference. Furthermore, while the compositions suggested by the reference can be forced to overlap Applicant's, there are thousands of other compositions possible which do not even remotely intersect the compositional limitations of Applicant's claims. Jap. '419 does not require Nd and/or Pr, at least about 40 atomic percent iron or greater than 0.5% B. None of the examples contains Nd or Pr nor suitable proportions of iron and boron. It would take more than routine experimentation by one skilled in the art to arrive at Applicant's invention based on the teachings of Jap. '419. [Emphasis added]

With a May 15, 1986 Office Action the Examiner cited the Koon 1981 article (FF 179) which NEOCO relies on in its prior art. In an amendment dated September 24, 1986, applicant argued (FF 180):

> All claims rejected over Koon '770 have been amended or canceled and rewritten to require at least about 6 atomic percent Nd and/or Pr. This is a substantially higher and patentably distinct amount of these rare earths than the 2 atomic percent maximum allowed by Koon. [Emphasis added]

Applicant in an amendment dated April 20, 1987 argued (FF 182):

> Dr. Croat discovered that iron-neodymium and iron-praseodymium based compositions could be rapidly solidified to form products having permanent magnet properties. That discovery was disclosed and claimed in his U.S. Patent No. 4,496,395. The subject application describes and claims improved compositions that incorporate boron. The addition of boron to iron-neodymium alloys, for example, provides a substantial increase in magnetic properties such as coercivity, energy product and Curie temperature. In the experience reflected in the many examples presented in the subject application, the preferred addition of boron to iron and neodymium or praseodymium based compositions is such that boron makes up about 0.5 to 10 atomic percent of the total composition. Particularly desirable permanent magnetic properties were observed in such mixtures described in the working examples of this application. However, there is no

suggestion in the application and indeed no technical basis for concluding from its teaching that higher boron additions are unsuitable for achieving improvements in magnetic properties in iron-neodymium- praseodymium based compositions. To the contrary, in the brief summary portion of the specification at pages 3 and 4, it is stated with reference to the basic formula $RE_{i-x}(TM_{i-y}By)x$ that the value of x is preferably in the range of about 0.5 to about 0.9 and y is preferably in the range of about 0.01 to about 0.20. Accordingly, in this disclosure of a preferred practice of the invention, the boron content could be at least about 18 atomic percent of the overall basic formula. Page 24, lines 27-32 of the specification teaches that boron additions over 10 atomic percent do not inhibit the essential magnetic phase even though magnetic properties may be diluted. In general, the Serial No. 544,728 -- 14 specification points out benefits of combining boron with iron and neodymium and/or praseodymium. There is no suggestion that boron content in excess of amounts described as preferred so change the magnetic properties of the overall compositions as to be outside the scope of the invention.

Claims 38, 43, 44, 48, 50, 51, 58, 60, 61, 64 and 66-69 are presented in the application to recite the invention in a different form than other claims that recite a boron content range. They require that a magnetically hard alloy composition be formed and that it contain a specified range of rare earth elements and iron and a minimum amount of boron. These claims also require minimum magnetic properties and/or the presence of the essential magnetic phase $RE_2TM_{14}B_1$. In other words, they provide compositional ranges for two of the necessary constituent element types, they provide a minimum amount of the third necessary constituent, boron, and they require that the overall material cooperate to provide certain minimum permanent magnet properties and/or a specific iron-neodymium/praseodymium-boron containing phase. The law does not require applicant's claims to provide a detailed recipe of his permanent magnets. The law requires the claims to distinctly claim the invention. It is respectfully submitted that claims 38, 43, 44, 48, 50, 51, 58, 60, 61, 64 and 66-69 accomplish this requirement and satisfy 35 USC 112. [Emphasis added]

On Dec. 2, 1988 the Examiner indicated that the claims were in condition for allowance. (FF 188). Thereafter the '931 patent issued on Feb. 7, 1989. (FF 47).

The prosecution of the '931 patent makes clear that the claimed subject matter in issue relates to permanent magnets or magnetically hard alloy compositions containing neodymium and/or praseodymium with specified amounts of iron and boron and requiring minimum magnetic properties and/or the presence of the essential magnetic phase $RE_2TM_{14}B_1$. (See FF 174 to 188).

4. NEOCO's Arguments

Regarding Int. No. 103,182, relied on by NEOCO,[19] on Aug. 11, 1993 the Patent Office Board of Interferences declared that interference which involved (1) Croat's claims 1 through 20 of '931 patent and claims 1 through 11 of the '058 patent and (2) Koon's claims 1 thru 31 and 34 of reissue application 07/248,217 (the Koon '217 reissue application) which was assigned to the United States of America as represented by the Secretary of the Navy.

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[19] On June 25, 1999 complainants moved to strike (1) the exhibits relating to the Croat v. Koon Inter. No. 103,182, viz. RXN-82 (interference declaration with Board of Appeals opinion), RXN-105 (Koon Invention Disclosure), RXN-113 (Koon 4/29/94 declaration) RXN-114 (Koon fifth 5/23/94 declaration) and RXN-137 (reissue Serial No. 7/248,217) and (2) the '408 patent (RXN-104), its reissue patent U.S. No. Re 34,322 (RXN-134) and material relating to the prosecution of the reissue patent (RXN-135) and testimony contained on Tr. at 1765-66 and 1805-11 related thereto (Motion Docket No. 413-54). Respondent NEOCO opposed Motion No. 413-54. The staff supported Motion No. 413-54 with the exception of RXN-137 (See staff's letter dated July 11, 1999). RXN-82, RXN-105, RXN-113, RXN-114 and RXN-137 pertain to the issue of who was the first to invent the subject matter of the only count in the interference which is directed to a magnet made of certain amounts of unspecified rare-earth metals and other elements. RXN-104 is based on a continuation-in part application of Ser. No. 319,325 which resulted in the Koon '770 patent. Reissue patent RE 34,322 was not filed in the Patent Office until January 31, 1989 and issued on July 27, 1993. (FF 277). In determining the validity issues, the administrative law judge has considered the material in issue in Motion No. 413-54. Hence, while he finds that said material does not invalidate the claims in issue of the Magnequench patents, he is denying Motion No. 413-54.

(See CX-17, Tab 46; CX-20, Tab 46)). Count 1, and the only count, of the interference reads:

COUNT 1

> A permanent magnet alloy composition comprising, in atomic percent, 6 to 40 percent of at least one rare earth metal, 0.75 to 28.75 percent boron, 50 to 90 percent of at least one transition metal selected from the group consisting of iron and cobalt, 0 to 4.75 percent of at least one element selected from the group consisting of phosphorus, silicon, aluminum, arsenic germanium, indium, antimony, bismuth, and tin and from 0 to less than 20 percent based upon the iron content in the alloy of at least one additive metal selected from the group consisting of titanium, nickel, chromium, zirconium, and manganese where said alloy contains the tetragonal phase $RE_2TM_{14}B_1$ wherein RE represents the rare earth metals, TM represents the transition metals and B represents boron. [Emphasis added] [FF 173]

In Interference No. 103,182 the declaration declaring the interference designated the patentee Croat the junior party and Koon was designated the senior party. The Koon '217 reissue application is a reissue application of the Koon '770 patent. The senior party Koon was accorded the benefit of Ser. No. 06/314,325 filed 10/23/81 (now the '770 patent). The junior party Croat, as to the '931 patent, was accorded the benefit of Serial No. 06/508,266 filed 6/24/83 and 06/414,936 field 9/13/82 (now the '058 patent). (RXN-82).

Prior to the declaration of Interference No. 103,182, the Koon '217 issue application had been rejected by the Examiner, and Koon had appealed to the Board of Patent Appeals and Interferences of the U.S. Patent and Trademark Office (PTO), where he won a reversal of the Examiner's rejection of claims 1 through 31 and 34 which were all the claims remaining in the Koon '217 reissue application and which had been rejected under the second paragraph of 35 U.S.C. § 112. The Board, on reversing the Examiner, stated (footnote omitted) (RXN-82):

> The claimed polycrystalline materials are prepared by annealing

amorphous alloy precursors, which precursors are necessarily limited to compositions capable of being formed into amorphous alloys. Lanthanides are normally incorporated for desirable properties, e.g., a high coercive force. However, crystallinity is favored with increasing amounts of lanthanides. See, for example, column 5 of Koon '043 [Koon U.S. Pat. No. 4,409,043 which was based on Ser. No. 314,326 filed Oct. 23, 1981 and which issued on 10/11/83], lines 5 through 30, wherein it is disclosed that crystallinity occurs when as little as one atomic percent of a heavy lanthanide is added to an alloy containing iron and boron. Appellant's invention resides in incorporating lanthanum, thereby enabling greater amounts of lanthanides to be present in the alloy precursors without observable crystallinity vis-a-vis alloy precursors sans lanthanum.

The invention defined in the appealed claims cannot be said to be indefinite on its face. The examiner focuses upon column 2 of the '770 patent, lines 48 through 50 [Koon U.S. Pat. No. 4,402,770 which was based on Ser. No. 314,325 filed Oct. 23, 1981 and which issued on Sept. 6, 1983] which read as follows:

> "It is possible to alloy iron and boron with the lighter lanthanides (Ce, Pr, Nd) in concentration of less than two atomic percent."

The examiner contends that this sentence creates a subgenus of lighter lanthanides which can be present in an amount less than two atomic percent without observable crystallinity, in the inventive alloys containing lanthanum. The examiner concludes that the appealed claims are "incomplete." The examiner is presumably of the opinion that one having ordinary skill in the art would have been confused whether the appealed claims were intended to encompass alloys containing in excess of two atomic percent of the lighter lanthanides.

We agree with appellant's interpretation of the disclosure of the '770 patent, including column 2, lines 48 through 50. We particularly note that there is nothing in the sentence relied upon by the examiner to indicate that it relates to alloys containing lanthanum. The only reasonable interpretation of that sentence, consistent with the entire disclosure, is as appellant urges, i.e., that the two percent limitation on the amount of lighter lanthanides applies to the preparation of the amorphous

> precursors alloys made without lanthanum. As argued on pages 15 through 17 of the Brief, appellant's position is supported by Table 1 of Koon '043 [see FF 275] which reveals alloys having amounts of heavy lanthanides in excess of two atomic percent, yet Koon '043 suggests it is more difficult to alloy the heavy lanthanides than the light lanthanides without observable crystallinity. [Emphasis in original]

With this reversal, Koon obtained allowable patent claims that appeared to interfere with claims of the '931 and '058 patents. Accordingly Int. No. 103,182 was declared containing only one count, supra. The parties in Int. No. 103,182 filed preliminary motions and preliminary statements by May 2, 1994. Oppositions to those motions and replies have been filed. However there have been no decisions to date on the preliminary motions much less the ultimate issue involving Count 1.[20] (RXN-82).

The administrative law judge finds that the fact that Int. No. 103,182 has been declared does not affect the validity of the asserted claims of the '058 and '931 patents since there has been no decision in said interference.[21] Moreover, the ultimate issue in Interference No. 103,182 is separate and distinct from the issues in this investigation. Thus the ultimate issue in the interference, which has yet to be decided, is who is the first to invent the subject matter of a single count, supra, which is directed to a magnet made of certain amounts of unspecified

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[20] The other Magnets patents at issue in this investigation (i.e., the '395, '723, '368 and '651 patents) are not involved in Interference No. 103,182. (RXN-82). Furthermore the Koon '043 patent (FF 275) and '408 patent (FF 276) are not involved and only the Koon '217 reissue application, not the '770 patent itself, is involved. Id. Also the Board of Patent Appeals and Interferences never declared that Koon's '770, '043 and '408 patents were "senior" to Croat's '058 and '931 patents, since those Koon patents are not involved in the interference. (RXN-82).

[21] While NEOCO argued that Interference No. 103,182 is relevant with respect to the Magnequench patents, the '395 patent was not involved in said interference. (RXN-82).

rare-earth metals not the specific <u>light</u> rare-earth metals, neodymium or praseodymium and other elements. In contrast, in this investigation the validity issues under 35 U.S.C. §§ 102 and/or 103 concerning the Magnequench patents must focus on the asserted claims of those patents which (1) relate, with respect to the broadest claim of the '395 patent in issue, to a permanent magnet alloy having an inherent intrinsic magnetic coercivity of at least 5000 Oersteds at room temperature comprising iron and one or more specific rare-earth elements taken from the group consisting of neodymium and praseodymium, and (2) relate, with respect to the broadest claims of the '058 and '931 patents, to magnets and magnetic materials containing, <u>inter alia</u>, certain critical amounts of neodymium and/or praseodymium. Therefore the issues raised in the interference, which does not even concern the '395 patent, and the issues raised in this investigation are distinct and not the same.

Moreover, in the Koon '217 reissue application involved in Interference No. 108,182, results from the following alloy compositions were shown. (Col. 4, Table 1 of the '770 patent).[22]

TABLE 1

Alloy	Intrinsic Coercive Force (Oe)
$(Co_{.74}Fe_{.06}B_{.20})_{.94}Sm_{.01}$	930
$(Co_{.74}Fe_{.06}B_{.20})_{.95}Sm_{.02}La_{.03}$	1120
$(Fe_{.82}B_{.18})_{.95}Tb_{.03}La_{.02}$	3000
$(Co_{.74}Fe_{.06}B_{.20})_{.94}Sn_{.03}La_{.03}$	1670
$(Fe_{.82}B_{.18})_{.9}Tb_{.05}La_{.05}$	8500
$(Fe_{.82}B_{.18})_{.9}Sm_{.05}La_{.05}$	600
$(Fe_{.85}B_{.15})Tb_{.05}La_{.05}$	9400
$(Fe_{.88}B_{.12})Tb_{.05}La_{.05}$	9600
$(Fe_{.82}B_{.18})_{.9}Tb_{.06}La_{.04}$	8400

[22] RXN-137 does not include the '770 patent (CX-18, Tab 20) on which the '217 reissue application is based. However the reissue application is a reissue of the '770 patent and hence there are common disclosures in the '770 patent and reissue application.

In addition alloy compositions of $(Fe_{0.82}B_{0.18})_{0.9}$ $Tb_{0.05}La_{0.05}$ and $(Fe_{0.82}B_{0.18})_{0.9}$ $Tb_{0.25}La_{0.05}$ were prepared. (CX-18, Tab 20, col. 5 of '770 patent). Only the identified alloy compositions from TABLE 1 and col. 5 were specifically disclosed in the '770 patent. Thus Koon may prevail in the interference by just relying on his work with his terbium-lanthanum alloy (the alloy most frequently referenced in the Koon '217 reissue application). However even if Koon were to show in Interference No. 103,182 that he invented a terbium (a heavy rare earth element)-lanthanum alloy falling within the sole count of the interference before Croat invented a neodymium or praseodymium-containing magnet falling within said count, that does not show that Koon invented the compositions of the claims in issue of the '395, '058 and/or '931 patents.

NEOCO refers to a purported invention disclosure (RXN-105) which was submitted in the Croat v Koon interference.[23] Complainants however did not have an opportunity to cross-examine Koon on RXN-105 since Koon is now deceased. Also while RXN-105 lists as witnesses C. M. Williams, B.N. Das. and D.J. Gillespie, NEOCO provided no evidence to corroborate the statements in the invention disclosure from any corroborating witnesses.

In addition the invention disclosure is directed to a "method of producing permanent magnets ... [consisting] of first making an amorphous alloy, then heat treating it to produce a crystalline material which exhibits large magnetic hysteresis." (RXN-105). The only

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[23] There is no evidence that RXN-105 was publicly available (if at all) before the effective filing date of the '058 patent and the '931 patent, viz. 9/3/82. (FF 32, 47, 48). The effective filing date of the '395 patent is June 16, 1981 which is earlier than the June 19, 1981 date of RXN-105. (FF 19). Also NEOCO presented no evidence that the composition described in RXN-105 was ever reduced to practice within the meaning of 35 U.S.C. § 102(g).

composition described in the invention disclosure is a terbium alloy which is also described in a Koon 1980 abstract. The invention disclosure further provides only a generic reference to "any of the rare-earth elements" and does not contain any specific reference to neodymium and/or praseodymium. (FF 286, 287). Thus RXN-105 does not describe a composition containing neodymium and/or praseodymium, iron and boron, much less a composition at least six atomic percent neodymium and/or praseodymium as required in the claims in issue the of the '058 patent.

RXN-105 also does not suggest a $RE_2TM_{14}B$, phase, let alone a predominate $RE_2TM_{14}B$, phase recited in the asserted claims of the '931 patent. To the contrary in a Koon 1982 article, (CX-443) Koon states that he performed transmission electron microscopy analysis on his terbium alloy and found that it consisted mainlyof Re_6Fe_{23} and Fe_3 B phases. (CX-443; CX-442, Q. 37). Also in a Koon 1983 article (CX-444) Koon reported that he again found that his terbium alloy consisted mainly of RE_6F_{23} and Fe_3 B phases and there was no peak shown which peak is characteristic of the $RE_2Fe_{14}B$, phase. (CX-444; CX-442, Q. 40). A Koon 1984 article (CX-445) further disclosed that Koon's terbium alloy consisted mainly of RF_6 Fe_{23} and Fe_3B phases and the data presented in that article did not show the presence of an $RE_2Fe_{14}B_1$ phase. Moreover in that article, Koon specifically states that there was no evidence that any ternary or quaternary rare earth-iron-boron compounds were present in Koon's terbium alloy described in the article.[24] Since the $RE_2Fe_{14}B$ phase is a ternary compound, the

[24] NEOCO's expert Bohlmann testified that what one looks for in a magnet material is certain magnetic properties and that it is only after one has the desired magnetic properties in a material that one searches for the crystal structure and that generally the identification of the crystal structure would come after the alloy was formed. (Tr. at 1317, 1318). However even

administrative law judge finds that Koon's terbium alloy did not contain such a phase. (CX-445; CX-442, Q. 43). Based on the foregoing the administrative law judge finds that the invention disclosure RXN-105 carries no weight as to the validity of the asserted claims of the magnequench patents.

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though an alloy must be formed before one can determine its crystal structure, a particular structure, such as the 2-14-1 phase recited in claims in issue of the '931 patent, does not necessarily form when just any constituents are combined to form an alloy or composition. Thus as shown be Koon's work described in his 1982, 1983 and 1984 articles, a composition that contains terbium, lanthanum, iron and boron (i.e., rare-earth elements, transition metals and boron) did not form the 2-14-1 phase. (CX-443; CX-444; CX-445; CX-442, Q. 37, 40, 43). Rather, as shown by the '931 patent (CX-2), the formation of the 2-14-1 phase depends on (1) the use of specific rare-earth elements (such as neodymium or praseodymium), transition metals as iron and boron as well as (2) the amounts of those constituents. Bohlmann agreed at least that the benefits of adding boron to the neodymium-iron composition arises because boron allows the formation of the 2-14-1 phase and that in turn results in more favorable magnetic properties. (Tr. at 1549, 1550).

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In a telephone conference on May 13, 1999, at which NEOCO's counsel was present, this administrative law judge stated that he would want to hear about the facts involved in the interference at the hearing. (5/13/99 Tr. at 151).[26] Counsel for certain respondents made reference to Messrs. John Karasek and Tom McDonnell as long-time employees of the Navy and who worked with Koon and reviewed his research when Koon was alive and that there's "plenty of facts for them to testify to." (5/13/99 Tr. at 153). There was however no testimony from <u>any</u> witness at the hearing corroborating the Koon 5/24/94 declaration.

The Koon 1980 abstract (RXN-51),{

}makes no mention of using neodymium and/or praseodymium with iron and boron to create a high coercivity magnet. Rather it merely reports that it was found that "the addition of La [lanthanum] tends to suppress the formation of ... [stable rare-earth-iron

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[26] Inerference No. 103,182 is not in issue in this investigation and this administrative law judge has no jurisdiction to decide who is the first inventor of the sole count of that interference. NEOCO however has put in issue 35 U.S.C. §§ 102 and 103. <u>See</u> in particular 35 U.S.C. § 102(f) and (g). Hence the interference is relevant insofar as it relates to the validity of the claimed subject matter in issue of the Magnequench patents.

intermetallic compounds] and greatly increases the amount of rare earth which can be added while retaining the amorphous melt-quenched state." (FF 273). The only specific alloy disclosed is a iron-boron-terbium-lanthanum composition. The only rare earths mentioned in the abstract are terbium and lanthanum (Id). NEOCO's Bohlmann agreed that the 1980 abstract makes no "disclosure" of using neodymium and/or praseodymium with iron and boron to create a high coercivity magnet. (See Tr. at 1549).

NEOCO relies on testimony of Bohlmann that Koon's presentation at the MMM 1980 conference went beyond the 1980 abstract. That testimony (Tr. at 1538-1540) is far from convincing that this was in fact the case. Bohlmann at the hearing when asked by the administrative law judge how one would know the exact words said by Koon at the MMM 1980 conference, referred only to the 1980 abstract. (Tr. at 1539). Moreover while Bohlmann testified that he knows that Koon discussed more than what appears in the 1980 abstract Bohlmann had no recollection or notes that would indicate what Koon said. (Tr. at 1540). However complainants' counsel at the hearing then made reference to Bohlmann's deposition testimony where Bohlmann made reference to notes he may have taken at the conference. Bohlmann then testified that he did provide to NEOCO's counsel notes that Bohlmann had retyped. NEOCO's counsel stated that the notes were not in evidence (Tr. at 1540) and later stated "I don't know precisely where they are amidst our materials but I believe I have them here" (Tr. at 1543); that "we're not objecting to producing those notes if we can find them. We had not intended to use them and introduce them as an exhibit"; and that "[i]f we can find them, we will produce them. We don't intend to examine Mr. Bohlmann on the content of those notes." (Tr. at 1544)(Emphasis added). Any such notes were never produced. Moreover in view of the comments by NEOCO's counsel any such notes, if they do exist, carry no weight.

Moreover Koon himself in a declaration (FF 282) that accompanied the filing of the Koon '217 reissue application declared that an abstract of Koon's presentation was published in the program of the MMM 1980 conference and that the text of the presentation was published in the November 15, 1981 issue of Applied Physics Letters, Volume 39(10) at pages 840-842. (RXN-56). In the article in Applied Physics Letters (FF 285) (the Koon article), which contains the text of Koon's presentation at the MMM 1980 conference according to Koon in 1988, Koon states that rare earths can be added to binary iron-boron compounds to make magnetically hard compositions but only if lanthanum is added to the alloy:

> Very recently, we have discovered that FeB alloys containing moderate amounts of the heavy as well as light rare-earth elements can be made by conventional melt spinning techniques if a small amount of La is added to the alloy. The key point appears to be that La, which has no stable compounds with iron, seems to inhibit the formation of rare-earth intermetallic compounds during the quench process. The addition of small amounts of La (a few at. %) to FeB therefore makes possible the production in bulk of a wide class of amorphous iron-boron-rare-earth alloys containing typically up to 10-15 at. % rare earth, which is enough to significantly modify the magnetic and magnetostrictive properties of the alloys. [RXN-56] [Emphasis added].

Thus the text of Koon's presentation at the MMM 1980 conference reproduced in Applied Physics Letters at least indicates that Koon believed that one must use lanthanum in order to create a rare-earth-iron-boron composition with strong magnetic properties.[27] Hence the administrative law judge finds that Koon's

[27] The Koon article was before the Examiner during the prosecution of each of the applications which led to the issuance of the '058 and '931 patents. See supra.

presentation at the MMM 1980 conference teaches away from the claimed compositions of the '058 and '931 patents, which do not require lanthanum at all.[28]

A Koon 1981 abstract reports producing a new class of melt quenched amorphous alloys accomplished by the discovery that lanthanum "which has no stable compounds with iron, inhibits the formation of intermetallic compounds during the quench process." (FF 283). It teaches that the addition of just 2 atomic percent lanthanum to a particular iron boron composition, for example, raises the amount of terbium (Tb) which can be added from approximately 1 atomic percent to over six atomic percent. Id. The Koon 1981 abstract describes the same terbium alloy as described in the Koon 1980 abstract and Koon 1981

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[28] NEOCO argued that Dr. Sagawa remembered Koon's presentation at the 1980 MMM conference "very well" because Koon's ternary alloy with boron obtained "very interesting" magnetic properties, citing JX-1, Croat dep. at 113: 2-11; that Croat recalled that Koon's presentation discussed the use of boron with rare earths and iron, citing JX-1 Croat dep. at 223: 19-21; and that Fred Rothworth took detailed notes for Croat and Sagawa of the Koon presentation in 1980. (NPost at 21). However although Keem provided testimony in his answer to Question 46 (RXN- 101) regarding Rothworth's purported notes from Koon's presentation, neither Rothworth was produced for testimony, nor any purported notes of Rothworth was produced, by NEOCO and hence Keem's answer to question 46 was stricken. (Tr. at 1657-58). Moreover Keem in testimony admitted that Keem was not at Koon's presentation. (Tr. at 1658-59). The JX-1, Croat dep. at 113: 2-11, referenced by NEOCO refers to the melt-spinning of lanthanum/terbium-iron-boron which is referenced in the Koon 1981 article. (RXN-56). The JX-1, Croat dep. 223:19-21, referenced by NEOCO does not support NEOCO's allegation. Regarding testimony of Bohlmann that "some years after that [1980 MMM] conference, in a casual setting, Dr. Sagawa admitted that he had gotten his idea regarding the effectiveness of boron from the presentations at the 1980 Dallas conference. I assumed that he meant the Koon paper" (Tr. at 1351-52), the testimony is based on an assumption and no details were given by Bohlmann as to any such meeting. It is a fact however that Koon did discuss the melt-spinning of lanthanum/terbium-iron-boron at the 1980 MMM conference although the presentation was limited to the discovery that iron-boron alloys containing moderate amounts of the heavy as well as the light rare-earth elements can be made by conventional melt spinning techniques if a small amount of lanthanum is added to the alloy. (See RXN-56).

article. Each of those three publications does not disclose any permanent magnet alloy and/or permanent magnet containing neodymium and/or praseodymium much less the neodymium and/or praseodymium having an inherent intrinsic magnetic coercivity of at least 5000 Oersteds at room temperature as claimed in the asserted claims in issue of the '395 patent. Moreover those publications do not disclose a neodymium-iron-boron composition having the particular components and magnetic properties as well as the specified ranges and/or particular phase recitation set forth in the asserted claims of the '058 and '931 patent in issue. Because the Koon 1980 and 1981 abstracts and the Koon 1981 article do not set forth all the elements of the asserted claims of the '395, '058 and '931 patent, the administrative law judge finds that those publications cannot anticipate any of the asserted claims of the '395, '058 and '931 patents.

Likewise the administrative law judge finds that the Koon '770 patent does not anticipate the claims in issue of the '058 and '931 patents for the reasons successfully argued by applicant in the prosecution of the '058 and '931 patents. See supra.[29] Moreover the Koon '770 patent specifically states that the light rare earths neodymium and praseodymium are among the "nonpreferred lanthanides" whereas the heavy rare earths terbium, dysprosium, holmium, and erbium are the "preferred lanthanides." (FF 274).[30]

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[29] As applicant pointed out in the prosecution of the '395 patent, supra, the Koon '770 patent is not an effective reference, against the claims in issue of the '395 application. See supra. Also while the staff has argued that the Koon '770 patent is not prior art with respect to the '058 patent (SPost at 63), the Examiner in the prosecution of the '058 patent however did treat the '770 patent as prior art. See supra.

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Closely related to the Koon '770 patent is the Koon '408 patent. (FF 276). Because the Koon '408 patent is a continuation-in-part of the '770 patent (FF 276), certain parts of the '408 patent contain the same subject matter as the Koon '770 patent which has been treated, supra. As for the new matter in the remainder of the Koon '408 patent, the earliest possible effective filing date is September 6, 1983, the filing date of the continuation-in-part application for the '408 patent. (FF 276). That date, however, is more than a year after the effective filing date (September 3, 1982) of the subject matter in the '058 and '931 patents, to which any new matter in the '408 patent in allegedly relevant. Consequently the new matter in the Koon '408 patent is not prior art with respect to either the '058 or the '931 patent. Likewise the reissue patent of Koon '408 patent, viz., U.S. Patent No. Re 34, 322 (FF 277) is not prior art. See In re Chic, 66 F.3d 292, 297, 366 U.S.P.Q.2d 1089, 1093. (Fed. Cir. 1995).

Based on the foregoing the administrative law judge finds that NEOCO has not established by clear and convincing evidence that the claimed subject matter in issue of the '395, '058 and '931 patents is anticipated under 35 U.S.C. § 102 by any prior art.

Referring to NEOCO's arguments that the claimed subject matter in issue of the Magnequench patents has been shown to be obvious, under 35 U.S.C. § 103, obviousness cannot be established by picking and choosing among the prior art, and combining the teachings of the prior art to produce the claimed inventions, without showing the existence of

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some teaching or suggestion supporting the combination. Fromson v. Anitec Plates, Inc., 132 F.3d 1437, 1447, 45 U.S.P.Q.2d 1269, 1276 (Fed. Cir. 1998). Moreover hindsight is something which is to be studiously avoided when conducting an obviousness analyses. Rockwell International Corp. v. United States, 147 F.3d 1358, 1364, 47 U.S.P.Q.2d 1027, 1031 (Fed. Cir. 1998). The administrative law judge finds nothing in the publications of Koon that would enable a person of ordinary skill in the art to make the compositions set forth in the claims in issue of the '058 and '931 patents. There is no specific reference to any rare-earth in the Koon 1980 and Koon 1981 abstracts and the Koon 1981 article with the exception of lanthanum and the heavy rare earth terbium. In addition, the publications focus on using the heavy rare-earth element terbium rather than the light rare earth elements neodymium or praseodymium and describe lanthanum as being necessary to facilitate the addition of terbium and obtain an amorphous composition. NEOCO has cited no prior art which suggests the substitution of the light rare earth element neodymium or praseodymium for the heavy rare-earth terbium of those publications and/or the elimination or replacement of lanthanum which is not required by any of the claims in issue of the '058 and '931 patents. To the contrary the administrative law judge finds that the 1980 and 1981 Koon abstracts and 1981 Koon article taught away from using light rare earths, such as neodymium or praseodymium by emphasizing the advantages of the heavy rare earth terbium.

Regarding NEOCO's position at the hearing as to why the '395 patent is invalid, each of the Nesbitt '200 patent, Nesbitt '911 patent and Ostertag '889 patent was before the Examiner in the prosecution of the '395 patent. (FF 289, 296, 312).

The Ostertag '889 patent relates to a magnet made of rare-earth and cobalt.

(Bohlmann, Tr. at 1477, 1479). The Ostertag '889 patent does not contain a specific disclosure, or even a suggestion, that one should use neodymium or praseodymium with iron to make a magnet. (Bohlmann, Tr. at 1481, 1487-88). When the Examiner cited the Ostertag '889 patent during the prosecution of the application for the '395 patent, applicant amended his claims so they were limited to iron as the transition metal constituent of the claimed magnetic materials, and asserted that the claims as limited would not be anticipated or suggested by the Ostertag '889 patent. (CX-22 at M 002896-97) (See also FF 311 to 317).

The Nesbitt '200 patent relates to a magnetic composition of (1) iron, cobalt, or a mixture thereof, (2) copper, nickel, or aluminum, and (3) a rare earth. (CX-18 at M 001907, col. 1, lines 50-62). Like the Ostertag '889 patent, it does not contain a suggestion to use neodymium or praseodymium. (Bohlmann, Tr. at 1456). Also each of the claims of the Nesbitt '200 patent call for the inclusion of copper (or nickel or aluminum) in the claimed composition, an element which is not present in the claims of the '395 patent. (CX-18 at M 001910, col. 7, line 30 - col. 8, line 36). Moreover the specification of the Nesbitt '200 patent appears to teach away from the '395 patent in that the former indicates that copper (or nickel or aluminum) is needed to create a highly coercive magnetic material:

> The non-magnetic component B [copper, aluminum, or nickel] is responsible for minimizing or eliminating domain wall motion so that increasing amounts result in increasing coercivity. The dramatic improvements in coercivity thus obtained contributes one of the unobvious features of the invention.

(CX-18 at M 001907, col. 2, lines 14-18) (See also FF 295 to 305).

The Nesbitt '911 patent deals with a method for increasing the coercivity of thin layers of rapidly quenched material. (Bohlmann, Tr. at 1461). It does not indicate the coercivity of compositions made according to the invented method. (Bohlmann, Tr. at 1465-66). (See also FF 288 to 294).

With respect to the Shirk article, Bohlmann acknowledged that it has nothing to do with neodymium or praseodymium or even rare-earth and iron compounds. (Bohlmann, Tr. at 1475). Indeed, Shirk only teaches a process for rapid quenching to get a uniform particle size. Id. Bohlmann testified that the Shirk reference only has relevance if the claims at issue claim a process. Id. Insofar as the claims at issue are directed to compositions, and not processes, the administrative law judge finds that Shirk is irrelevant to any validity determination that is to be made with respect to the claims. (See also FF 306-307).

The Drozzina article appears to describe some sort of combination of neodymium and iron that exhibited strong magnetic properties, although with a coercivity of 4300 Oersteds, lower than the minimum coercivity set forth in the asserted claims of the '395 patent. (RXN-30; FF 318). While a 1959 Bozorth reference summarizes the Drozzina article,[31] it states that the composition and one of the magnetic properties of the material in the Drozzina article are uncertain because of inconsistencies in said article. (FF 321).

With respect to the Koon '770 patent, NEOCO has cited no prior art that would suggest raising the upper limit of 2 percent light rare earth element recited in the '770 patent, nor to counteract the specific recitation in the '770 patent that the nonpreferred lanthanides include praseodymium and neodymium which would teach away from using those light rare earth

[31] The Bozorth reference (RXN-7) inaccurately states that the coercive force observed by the authors of the Drozzina article was 4600 Oersteds instead of the actual 4300 Oersteds. (RXN-30).

elements.

NEOCO argued that certain claims of the '058 patent are "obvious under 35 U.S.C. § 103 in view of the '395 patent" (NPost at 47). The available prior art is defined by the pertinent subsections of 35 U.S.C. § 102. See Oddzon Products, Inc. v. Just Toys, Inc., 122 F.3d 1396, 1402, 1403-04, 43 U.S.P.Q.2d 1641, 1644-46 (Fed. Cir. 1977) (Oddzon). The '395 patent did not issue until January 29, 1985 (FF 19) over two years after Croat filed his application for the '058 patent. In addition, Croat is the sole named inventor on each of the '395 and '058 patents, which means that the '395 patent was not known or used "by others," or granted on an application "by another," prior to his invention of the '058 patent. 35 U.S.C. § 102(a, e). Hence, the administrative law judge finds that the '395 patent cannot be considered prior art under the pertinent subsections of 35 U.S.C. § 102. See 35 U.S.C. § 102(a, b, e); Oddzon, 122 F.3d at 1402, 43 U.S.P.Q.2d at 1644 (noting that subsection 102(e) is directed to applications filed by another). Moreover NEOCO has not pointed to a specific teaching or suggestion in the '395 patent and what said teaching or suggestion is to be combined with. Obviousness cannot be established by picking and choosing among the prior art, and combining the teachings of the prior art to produce the claimed invention, without showing the existence of some teaching or suggestion in the prior art supporting the combination. Fromson v. Anitec Printing Plates, Inc., 132 F.3d 1437, 1447, 45 U.S.P.Q.2d 1269, 1276 (Fed. Cir. 1998).

B. SSMC Patents

NEOCO argued that the SSMC '368, '723 and '651 patents are invalid in view of the sintering techniques of Yahagi patent application No. 56-17281 filed Feb. 15, 1980, laid open as No. 56-116844 (RXN-67) on Sept. 22, 1981 and published as No. 61-23848 (RXN-68) which issued on June 7, 1986. It is also argued that they are based on obvious sintering techniques, citing A Chronicle of the Development of Iron Bases Rares Earth High Performance Magnets" (1991). (NPost at 69-70).

Each of complainants and the staff argued that NEOCO has not established by clear and convincing evidence that the asserted claims of SSMC patents are invalid.

1. '368 Patent

The '368 patent issued on Dec. 20, 1988 and is based on Ser. No. 516,841 filed July 25, 1983. (FF 66). The '368 patent recites several priority applications, the earliest of which is Japanese 57-145072 (8/21/85)(FF 67).

Claims 2-6, 8-10, 15-19, 21, 23, 24, 28-31, 35, 37 and 38 in issue are directed to sintered anisotropic permanent magnets having certain magnets properties and containing (1) at least 62 atomic percent iron with cobalt substituted for a portion of the iron in an amount greater than zero and not exceeding 25 percent of the magnet, (2) 12 to 20 atomic percent element consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and Y (R element) wherein at least 50% of the element R consists of neodymium and/or praseodymium and (3) 5-18 atomic percent boron with the claimed magnet having a higher Curie temperature than a corresponding ferromagnetic Fe-B-R based compound containing no cobalt. In addition certain of the claims contains, or may contain, one additional M element selected from certain metals with specified percentages wherein the sum of M is no more than the maximum value of any one of certain specified values and the balance being at least 62 percent iron. (FF 77 to 98).

The '368 patent makes reference to certain prior art in the following (FF 70):

> If it could be possible to use, as the main component for the rare earth elements light rare earth elements that occur abundantly in ores without employing much cobalt, the rare earth magnets could be used abundantly and with less expense in a wider range. In an effort made to obtain such permanent magnet materials, R-Fe_2 base compounds, wherein R is at least one of rare earth metals, have been investigated. A. E. Clark has discovered that sputtered amorphous $TbFe_2$ has an energy product of 29.5 MGOe at 4.2° K., and shows a coercive force Hc=3.4 kOe and a maximum energy product (BH)max =7 MGOe at room temperature upon heat-treatment at 300°-500° C. Reportedly, similar investigations on $SmFe_2$ indicated that 9.2 MGOe was reached at 77° K. However, these materials are all obtained by sputtering in the form of thin films that cannot be generally used as magnets, e.g., speakers or motors. It has further been reported that melt-quenched ribbons of PrFe base alloys show a coercive force Hc of as high as 2.8 kOe.
>
> In addition, Koon et al discovered that, with melt-quenched amorphous ribbons of $(Fe_{0.82}B_{0.18})_{0.9}Tb_{0.05}La_{0.05}$, Hc of 9 kOe was reached upon annealing at 627° C. (Br=5 kG). However, (BH)max is then low due to the unsatisfactory loop squareness of magnetization curves (N.C. Koon et al, Appl. Phys. Lett 39 (10), 1981, pp. 840-842).
>
> Moreover, L. Kabacoff et al reported that among melt-quenched ribbons of $(Fe_{0.8}B_{0.2})_{1-x}Pr_x$ (x=0-0.03 atomic ratio), certain ones of the Fe-Pr binary system show Hc on the kilo oersted order at room temperature.
>
> These melt-quenched ribbons or sputtered thin films are not any practical permanent magnets (bodies) that can be used as such. It would be practically impossible to obtain practical permanent magnets from these ribbons or thin films. [Emphasis added].

In the prosecution of the '368 patent, while the application on which the '368 patent is based was filed on July 25, 1983 (FF 66), the claims which led to the claims in issue were not included in the application until November 1, 1984. (FF 191, 192). Applicants, with respect to the patentability of said claims over prior art cited by the Examiner, successfully argued that the presence of increasing amounts of cobalt causes the Curie temperature of the resulting magnet to increase which meant that the magnet can be used in higher temperature environments; that it would not be obvious to one of ordinary skill in the art to use neodymium and/or praseodymium in an amount of at least 50% of the total amount of rare earth percent as required by the claims; and that the novelty is in the stated percentages of iron. (FF 196 to 199). Thereafter following the filing of terminal disclaimers which disclaimed the portion of the term of any patent subsequent to July 22, 2003, the Examiner allowed the claimed subject matter. (FF 202).

The prosecution of the '368 patent shows that the asserted claims in issue were allowed on the ground that increasing amounts of cobalt in the claimed compositions causes the Curie temperature of the resulting magnet to increase and that critical to the claimed subject matter is the use of certain amounts of the light rare earths neodymium and/or praseodymium and certain percentages of iron. (See FF 190 to 202).

2. '723 Patent

The '723 patent issued on Sept. 13, 1988 and is based on Ser. No. 13,165 filed Feb. 10, 1987 which application was a continuation of abandoned Ser. No. 510,234 filed July 1, 1983. (FF 99). Claims 2-9, 13-20, 24-27, 31, 33 and 34 in issue are similar to the claims in issue of the '368 patent. However while the asserted magnet claims of the '368 patent must contain at least 62 atomic percent iron and cobalt is substituted for a portion of the iron in a certain amount with the claimed magnet having a particular Curie temperature, the claims in issue of the '723 patent are directed to sintered anisotropic permanent magnets containing: (1)

12 to 20 atomic percent rare-earth elements, and wherein at least 50 atomic percent of rare-earth elements consists of neodymium and/or praseodymium; (2) at least 56 atomic percent iron (not at least 62 atomic percent iron as in the '368 patent); and (3) 4 to 24 atomic percent boron (with no recitation of cobalt or particular Curie temperature as in the '368 patent) (FF 107 to 128; CX-462, Q&A 64). The specification of the '723 patent discloses that the invention of the '723 patent relates to novel magnetic materials and permanent magnets based on rare earth elements and iron without recourse to cobalt which is relatively rare and expensive. (FF 101 to 105).

In the prosecution of the '723 patent while the '723 patent is based on an application filed July 1, 1983, the claims in issue were based on claims introduced into the application on October 25, 1984. (FF 205). Applicants, with respect to prior art cited by the Examiner, argued that to achieve the noted advantageous results in accordance with various aspects of the invention, it is important that certain compositional and microstructural requirements be met. (FF 206, 208, 211). Referring to the Koon '770 patent it was argued (FF 206):

> Koon U.S. 4,402,770, relates to hard magnetic alloy comprising defined amounts of iron, boron, lanthanum and a lanthanide. The non-preferred lanthanides are cerium, praseodymium, neodymium, europium, gadolinium, ytterbium and lutetium. The most preferred lanthanides are terbium, dysprosium, holmium and erbium. The alloys are prepared by heating the corresponding amorphous alloy to a temperature of about 850 to 1200°K in an inert atmosphere until a polycrystalline multi-phase alloy with an average grain size not exceeding 400 angstroms is formed.
>
> As has previously been pointed out and as should be apparent to those of ordinary skill in the art, permanent magnets prepared by rapid quenching of molten material into amorphous or finely crystalline material are not suitable for the preparations of

materials or magnets which have anisotropic magnetic properties. It is therefore no wonder that Koon at column 2, lines 3-4 specifically states:

> "And another object is to prepare isotropic permanent magnets having moderately high magnetization" ...

Due to the significant differences between substances which display isotropic magnetic properties and those which are anisotropic in nature, applicants respectfully submit that this distinction should be sufficient for withdrawing Koon as a basis for rejection.

The differences between the isotropic permanent magnets of Koon and the permanent magnets of the present invention are underscored by the recitation in many of the claims that the material or magnet is sintered. If sintering were applied to the alloy of Koon, the essential premise of the microstructure of the rapidly quenched alloys would be destroyed since sintering would generally result in a much coarser crystal grain size (counted as a normal crystalline alloy). The same holds true for all the rapidly quenched alloys.

Notwithstanding the previous points regarding Koon, there are many additional distinctions possessed by the presently claimed invention over the cited reference. In particular, no claim of record encompasses a composition wherein lanthanum is employed as the sole rare earth element. Instead, the claims either require that 50% of the total amount of rare earth element be the sum of neodymium and praseodymium when certain rare earth elements including lanthanum are present or require such amount of neodymium and praseodymium in general. This requirement is in part due to the discovery that the use of lanthanum alone in the composition provides difficulty in yielding a substantially tetragonal crystal structure and does not result in the advantages magnetic properties.

... Koon discloses that lanthanum may be used alone and .... the patent explicitly describes the rare earth elements praseodymium and neodymium as being non-preferred....

To further understand the content of Koon, reference may be

> made to articles 16 and 17 (authored by Koon et al) of the concurrently filed Information Disclosure Statement. Article 17 [the Koon 1981 article relied on by NEOCO] discloses on page 841, left column, line 10 et seq., that Fe-B and Fe-Tb intermetallic compounds occur with a grain size less than 1 micron due to crystallization, i.e., annealing. Thus, unlike the present invention, no Fe-B-R ternary intermetallic compounds occur in Koon. Article 16, on page 2334, fig. 3 shows the magnetic ordering temperatures Tc(k), i.e., Curie temperatures of their amorphous alloys. These values are much lower than those of the FeBR alloys of the present invention. The above differences exhibit the occurrence of different crystal phases between the disclosed rapidly quenched ribbon alloys and the Fe-B-R alloys of the present invention. [Emphases added].

Thereafter following the filing of a terminal disclaimer which disclaimed the terminal part of any patent granted beyond July 22, 2003, the Examiner allowed the claims in issue. (FF 214, 215). As the prosecution of the '723 patent establishes allowance of the claimed subject matter in issue was dependent on meeting certain compositional and microstructural requirements. (See FF 203 to 215).

3. '651 Patent

The '651 patent issued on July 8, 1997 on application Ser. No. 485,183 filed June 7, 1995. (FF 129). Ser No. 485,183 inter alia is a division of the application which resulted in the '368 patent and a continuation-in-part of the application which resulted in the '723 patent. (FF 130). Thus the language of the specification of the '651 patent is substantially the same as that of the specification of the '368 patent but not the specification of the '723 patent. (FF 130, 132). The asserted independent claim 1 and dependent claims 2-3, 5, 15, 18, 19, 21 and 22 of the '651 patent in issue are generally directed to a certain "crystalline compound" having a stable tetragonal crystal structure with lattice constants of a_0 about 8.8. angstroms and c_0

about 12 angstroms and containing iron and/or cobalt and boron, certain rare-earth elements and certain additional elements. (FF 139 to 147; CX-442, Q&A 87). There is no requirement in the independent claim in issue that praseodymium or neodymium be present in the claimed compound. The specification of the '651 patent recites that the magnetic materials and permanent magnets according to the invention of the '651 patent are essentially formed of alloy comprising "novel" intermetallic compounds and are crystalline. (FF 135, 136). Following rejections under 35 U.S.C. § 112, the claims in issue were allowed. (FF 220).

Allowance of the claimed subject matter in issue of the '651 patent was predicated on the fact that the claimed crystalline R(Fe, Co)BXAM compound had a tetragonal crystal structure having certain lattice constants. (FF 218).

4. NEOCO's Arguments

The Yahagi application, which is Japanese patent application No. 56-116844 and is relied upon by NEOCO, was before the Examiner during prosecution of the '368 and '721 patents. (FF 323, 326).[32] The Yahagi application is directed only to a method for preparing a magnet that is composed of a rare-earth element and one or more other elements. (FF 327). Bohlmann admitted that the Yahagi application does not teach sintering (FF 328) and thus the method disclosed in the Yahagi application would not include a sintering process. In addition, the Yahagi application is not directed to any particular composition, nor does it expressly mention neodymium or praseodymium or any composition that combines those elements with iron and boron. (FF 327, 329, 330, 331, 340, 346). Instead, the Yahagi application generally states that

[32] The administrative law judge finds the Yahagi references (RXN-67 and RXN-68) identical in all relevant respects.

the rare-earth element can be one of any of the 15 or so known rare-earth elements. (FF 329). Moreover, each of the only two examples disclosed in the Yahagi application use the rare-earth element samarium, rather than neodymium or praseodymium. (FF 336). There is no teaching that neodymium and/or praseodymium could be used to replace samarium to produce compounds having the compositions and/or magnetic properties set forth in the claims in issue of the '723, '368 patents. (FF 337). Thus, the administrative law judge finds that the Yahagi application does not describe or suggest the use of neodymium and/or praseodymium, much less the particular concentrations and/or magnetic properties of such elements required by the claims in issue of the '723 and '368 patents.

Similarly, the Yahagi application states that a rare-earth magnet contains at least one of the seven known transition metals with no direction or indication as to using any specific transition metal such as iron and/or cobalt as required by the claims in issue of the '723, '368 and '651 patents. (FF 331). Moreover, as Bohlmann admitted, the only example in the Yahagi application that includes iron uses an amount of iron (20 weight percent, which corresponds to 24 atomic percent), which is well below the minimum concentration of 56 atomic percent or 62 atomic percent required, respectively, by the claims in issue of the '723 and '368 patents. (FF 338, 340). Thus, the Yahagi application does not describe or suggest using iron, as opposed to any other transition metal, nor does it suggest the particular concentrations of iron required by the claims in issue of the '723 and '368 patents. (FF 339, 340).

Likewise, the Yahagi application states that one or more of non-metallic elements, drawn from a list of at least eight such elements, including boron, may be added to the composition in order to sufficiently promote the conversion of the material to the amorphous state. (FF 333). As

Bohlmann admitted, the Yahagi application does not require the use of any non-metallic element, much less does it require the presence of boron. (FF 340). Thus, the administrative law judge finds that Yahagi application does not describe or suggest the compositions set forth in the claims in issue of the '723, '368, and '651 patents, all of which require the presence of boron as well as other elements. In addition the Yahagi application does not describe or suggest that cobalt could be substituted for iron in an amount greater than 0 and up to 25 atomic percent of the magnet, nor does it teach that a magnet containing cobalt has a higher Curie temperature than a corresponding Fe-B-R based compound that does not contain cobalt, as required by the claims in issue of the '368 patent. (FF 342).

In addition the claims in issue of the '651 patent require that the compounds have a stable tetragonal crystal structure, with lattice constants a_0 and c_0 of about 8.8 and 12 angstroms, respectively. (FF 139 to 147). Bohlmann admitted that the Yahagi application does not describe or suggest the formation of any particular crystalline phase, much less a crystalline phase having a stable tetragonal crystal structure and the claimed lattice constants. (Tr. at 1688).

Referring to NEOCO's argument that the claims in issue of the '723, '368 and '651 patents are based on obvious sintering techniques, said claims do not claim as novel the sintering process per se. Rather the claims in issue of the '723 and '368 patents claim sintered anisotropic permanent magnets of particular neodymium and/or praseodymium-iron-boron compositions, which have a number of additional chemical, physical and magnetic properties while the asserted claims of the '651 patent claim a crystalline compound having a stable tetragonal crystalline structure and with specified lattice constants and containing certain rare-earth elements, iron and/or cobalt and boron as well as certain additional elements as specified.[33] The administrative law judge can find no evidence in the record that the particular compositions claimed in the asserted claims of the '721, '368 and '651 patents were known in the art and that it would have been obvious to sinter their particular compositions in such a way as to yield compositions having the specific, magnetic and chemical properties set forth in said claims. Moreover the administrative law judge finds the record lacking of any evidence in the prior art to suggest that a person of ordinary skill in the art would have found it obvious to combine either the Yahagi application or sintering techniques with other art to produce the compositions claimed in the SSMC patents.

C. Secondary Considerations

Secondary considerations, or "objective indications of nonobviousness," such as long felt need, commercial success, failure of others, copying, and unexpected results should be considered in a 35 U.S.C. § 103 determination. Graham, 393 U.S. at 17, Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc., 796 F.2d 443, 446 (Fed. Cir. 1986), cert. denied 484 U.S. 823 (1987). For objective evidence to be accorded substantial weight, its proponents must establish a nexus between the evidence and the merits of the claimed invention. Stratoflex, Inc. v. Aeroquip Corp., 713 F.2d 1530, 1539, 218 U.S.P.Q. 871, 879 (Fed. Cir. 1983) (Stratoflex).

Complainants argued that secondary considerations demonstrate the nonobviousness of the asserted claims of the patents in issue. (CPostR at 65-66, Tr. at 2261-2262).

NEOCO argued that complainants' reliance on commercial success as an "objective

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[33] The asserted claims of the '651 patent do not require that the claimed compound be sintered.

indicia" of nonobviousness is misplaced because complainants have achieved their commercial success through their methods of unfair competition. (NPostR at 8).

The staff did not address secondary considerations.

The administrative law judge finds that there is evidence of complainants' commercial success with respect to the sale of products that embody the claims in issue. Thus, with respect to the Magnequench patents, Magnequench's worldwide sales of its Nd-Fe-B products totaled approximately{ }in 1998. (FF 352, see also Order No. 39, Unreviewed Initial Determination On Domestic Industry, (May 3, 1999)). With respect to the SSMC patents, a number of firms are licensed to make Nd-Fe-B compositions by SSMC. (FF 353). One of SSMC's licensees,{

} Thus, both Magnequench and SSMC have been commercially successful with respect to the products that embody the inventions of the patents at issue, and the evidence shows that such success is a result of the merits of the invention. In other words, there exists a nexus between the sales and the merits of the invention as required by Stratoflex.[34]

Regarding both the Magnequench and SSMC patents, the administrative law judge finds that there is evidence in the record that demonstrates that there was in the magnet industry a long felt need to find a commercially viable substitute for the Sm-Co magnets which were the predecessors to Nd-Fe-B magnets. (FF 348). The administrative law judge also

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[34] While NEOCO argued that complainants cannot rely on commercial success as a factor in the secondary considerations analysis because said success was obtained through unfair competition, as the administrative law judge found infra the record does not support a finding of unfair competition.

finds that there is evidence in the record that shows that Nd-Fe-B magnets met the industries long felt need although the evidence does not appear to relate specifically to the compositions of the claims in issue. Thus, there is unrefuted testimony of complainants' Wheeler that Nd-Fe-B magnets offer many advantages over their predecessors, the Sm-Co (Samarium-Cobalt) magnets. Said advantages include that Nd-Fe-B magnets can achieve energy products higher than Sm-Co magnets, and that Nd-Fe-B magnets are composed of materials that are generally cheaper than samarium and cobalt. (FF 349-350). There is also evidence in the record that said Nd-Fe-B magnets have surpassed Sm-Co magnets as the industry standard. (FF 351).

D. Conclusion

Regarding the burden of proof concerning any invalidity defenses, under 35 U.S.C. § 282, a patent is presumptively valid and the burden, under a "clear and convincing evidence" standard of proving invalidity, rests on the accused infringer. Innovative Scube Concepts Inc. v. Feder Industries Inc., 26 F.3d 1112 (Fed. Cir. 1994).

Commission precedent, consistent with the standard set by the Federal Circuit for invalidity challenges in a patent infringement action, is that a validity challenge is subject to the clear and convincing standard. Certain Condensers, Parts Thereof And Products Containing Same, Including Air Conditioners For Automobiles, Inv. No. 337-TA-334, Commission Opinion at 9 (1993), aff'd in part, rev'd in part sub. nom. Modine Manufacturing Co. v. United States International Trade Commission, 75 F.3d 1545 (Fed. Cir. 1996); Certain Curable Flouroelastomer Compositions And Precursors Thereof, Inv. No. 337-

TA-364, Initial determination at 53 (1994).[35]

Based on the foregoing the administrative law judge finds that NEOCO has not shown by clear and convincing evidence that the asserted claims of the '395, '058, '931, '368, '721 and '651 patent are not valid under 35 U.S.C. § 102 or § 103.

V. Validity (Inventorship - '395 Patent)

NEOCO argued that melt spinning is a means of controlling the cooling rate of the molten alloy to obtain favorable crystal composition (NPost at 28); that the '395 patent specification doesn't describe any rapid quenching process other than melt spinning (NPost at 43); that John Keem was the first one to suggest using melt spinning to solidify rapidly the materials (NPost at 28); that Keem, alone, conceived and built the melt spinner used by the GM laboratory (NPost at 28, 44); that Keem conceived of melt spinning Re-Fe (rare-earth iron) (NPost at 44); and that because the only disclosed way to make the Nd-Fe-B magnet was by melt spinning Re-Fe, then Keem with Croat is a joint inventor with respect to the '395 patent. (NPost at 43).[36]

Both complainants and the staff argued that Croat is the sole inventor of the '395 patent

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[35] NEOCO argued that the burden of proving the patents at issue invalid in this investigation should be the lesser standard of preponderance of the evidence instead of the clear and convincing standard which is normally applied in patent litigation. (NPost at 32-35). In support, NEOCO cited Bruning v. Hirose, 48 U.S.P.Q.2d 1934 (Fed. Cir. 1998) for the proposition that the preponderance of evidence standard applies to validity challenges made during interference proceedings before the U.S. Patent and Trademark Office (PTO). This proceeding however is not an interference proceeding before the PTO. Rather it is a statutory patent based investigation under section 337 of the Tariff Act of 1930, as amended.

[36] While NEOCO asserts that all of the Magnequench patents are invalid for improper inventorship, NEOCO only addressed its arguments to the '395 patent.

(CPost at 81, SPost at 66); that Keem's involvement was limited to the suggestion of using melt spinning; that melt spinning was already known in the art (CPost at 82, SPost at 66); and that a simple suggestion that Croat use a technique that was already well known in the art is not sufficient to require naming Keem as a joint inventor. (CPost at 82, SPost at 66).

Title 35 requires that an applicant for a patent disclose the names of all inventors. 35 U.S.C. §§ 11. 115-16. It is well established that "[p]atent issuance creates a presumption that the named inventors are the true and only inventors." Ethicon, Inc. v. U.S. Surgical Co., 135 F.3d 1456, 1460 (Fed. Cir. 1998) (Ethicon) (citing Hess v. Advanced Cardiovascular Systems, Inc., 106 F.3d 976, 980 (Fed. Cir. 1997) (Hess)). This is a strong presumption to overcome on the basis of nonjoinder: "the burden of showing misjoinder or nonjoinder is a heavy one that must be proved by clear and convincing evidence." Hess, 106 F.3d at 980; Fina Oil & Chemical Co v. Ewen, 123 F.3d 1466, 1466, (Fed. Cir. 1997) (Fina). Furthermore, an alleged inventor must provide corroborative evidence of any asserted contribution to the conception of the invention. Fina, at 1474.

A "[c]onception is the 'formation in the mind of the inventor, of a definite permanent idea of the complete and operative invention, as it is hereafter to be applied in practice.'" Hybritech, Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1376 (Fed. Cir. 1986). Conception is complete when one of ordinary skill could reduce the invention to practice, without extensive research or experimentation. Sewall v. Walters, 21 F.3d 411 (Fed. Cir. 1994). Moreover, "[c]onception is the touchstone of inventorship," and each inventor must generally contribute to the conception of the invention. Ethicon, 135 F.3d a 1460 (citing Burroughs Wellcome Co. v. Barr Lab., Inc., 40 F.3d 1223 1227-28 (Fed. Cir. 1994)).

However simply providing well known principles or explaining the state of the art without ever having a firm and definite idea of the claimed combination as a whole does not qualify one as a joint inventor. Ethicon, 135 F.3d at 1460.

Croat was employed by General Motors Corporation (GM) in 1972. Jan Herbst joined GM in 1977 and has been continuously employed by GM since 1977. Keem also joined GM in 1977, but left GM in 1980. (FF 354-355; RXN-101 Q&A 4). Between 1977-1978 all three, as part of a team, were asked by GM to find alternatives to samarium-cobalt (Sm-Co) magnets. (FF 356).

Croat was named as the sole inventor on the Magnequench patents. The administrative law judge finds that at the time Croat was performing his experiments, it was thought that the best way to produce high-coercivity magnets was to cool them as quickly as possible. (FF 367). At some point, however, Croat decided to slow down the rate at which the alloy was cooled (the "cooling rate" or "quench rate") (FF 367). By slowing the quench rate, Croat found to his surprise that the alloys had much higher coercivities – as high as 8 kOe. (FF 367). His optimization of the cooling rate lead to the high coercivity neodymium-iron and praseodymium-iron magnets that are claimed in the asserted claims of the '395 patent. (FF 367). Indeed, the '395 specification distinguishes Croat's high coercivity magnets from "any like composition previously formed by melt spinning . . . " (FF 368). Because Keem left the project in its initial phases in the fall of 1979, Keem was not involved in Croat's experiments with neodymium-iron and praseodymium-iron alloys, including Croat's discovery of the advantages attained by slowing the quench rate. (FF 364, 369). In fact, for several months after Keem's departure, the melt spinner was not used until Croat began to use it in his research on melt-spinning neodymium-iron and praseodymium-iron alloys. (FF 365, 366).

The administrative law judge finds that Keem was responsible for the suggestion that melt spinning be used. (FF 357). However, the administrative law judge also finds that melt spinning was, at the time of Keem's suggestion, well known in the art, and that melt spinners were standard equipment in laboratories that performed rapid solidification experimentation and represented a well known technique to make amorphous alloys. (FF 357, 358).

The administrative law judge further finds that, while Keem built the melt spinner (FF 359), the melt spinner was not substantially different or more advanced from any other melt spinner known at the time. (FF 360, 361). Thus, Keem's suggestion to use a melt spinner, and his construction of said melt spinner was not "conception" of part of the "operative invention" as required by Ethicon.

The administrative law judge finds that after Keem built the melt spinner, both Croat and Keem tested it by making some iron-boron and indium samples, none of which contained any rare-earth elements. (FF 362).[37] The administrative law judge also finds that Keem left the

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[37] The transcript of the cross examination of Herbst reads in part:

> Q. But it [the melt-spinner] was also used by Dr. Keem before he left the project, is that right?
>
> A. A bit. Very little. He melt spun some neodymium and iron-boron, as I believe, and then left for the knock-sensor project.

(Herbst, Tr. at 2011) (Emphasis added). Herbst, however, in his direct testimony stated "I recall that Dr. Keem then tested the melt spinner by solidifying molten iron-boron and indium samples." (Herbst, CX-462, Q. 23) (Emphasis added). Herbst further testified in his direct testimony that "I do not believe that Dr. Keem made any neodymium-iron and praseodymium-iron samples." (Herbst, CX-462, Q. 23). In view of Herbst's direct testimony that Keem worked with indium, and in light of Herbst's further testimony that Keem did not work with neodymium or praseodymium, the administrative law judge finds, as the complainants argued (Tr. at 2224), that project shortly after testing the melt spinner in the fall of 1979 because he had lost interest in the project and was assigned to work on a different project. (FF 363). Keem testified that prior to leaving the project he was responsible for introducing to the group the idea of using a light rare earth iron instead of cobalt. (Keem Tr. at 1622). That testimony is uncorroborated. See Fina, supra. Moreover at the hearing complainants' counsel referred to deposition testimony of Keem where Keem stated that "the thought of using a light rare-earth and iron as opposed to cobalt were our- - were my- -or our idea." (Keem Tr. at 1622-23)(Emphasis added). Even assuming, arguendo, that Keem did suggest melt-spinning light rare-earths, the administrative law judge can find no evidence in the record to show that Keem ever suggested melt-spinning neodymium or praseodymium, which is the crux of the asserted claims of the '395 patent.

Based on the foregoing, the administrative law judge finds that NEOCO has not sustained its burden in establishing that the '395 patent or any other Magnequench patent in issue is not valid due to improper inventorship.

VI. Infringement

After the administrative law judge has construed the claim language in issue, he must determine whether any accused magnets falls within the scope of the asserted claims. H.H. Robertson, Co. v. United Steel Deck, Inc., 820 F.2d 384, 389, 2 U.S.P.Q.2d 1926 (Fed. Cir. 1987); Sofamor Danek Group, Inc. v. De Puy-Motech, Inc., 74 F.3d at 1216, 1218, 37 U.S.P.Q.2d 1529 (Fed. Cir. 1996). To find infringement, an accused magnet must meet each claim limitation, either literally or under the doctrine of equivalents. Charles Greiner & Co.

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the conflict with Herbst's cross-examination testimony is the result of a transcription error at 2011, line 14 in stating "neodymium" and not "indium."

v. Mari-Med Mgf., Inc. 962 F.2d 1031, 1034, (Fed. Cir. 1992). Complainants have the burden of proving, by a preponderance of the evidence, that the claims in issue are infringed by the accused products. See e.g. Conroy v. Reebok International, Ltd., 14 F.3d 1570, 1573 (Fed. Cir. 1994); Braun Inc. v. Dynamics Corp., 975 F.2d 815 (Fed. Cir. 1992); 4 Chisum, Patents, § 18.06[1] (1995).

A. Tests Performed On The Magnets Of Respondents, Former Respondents And Third Parties With Respect To The Magnet Patents

Complainants obtained samples of rare-earth Nd-Fe-B magnets from former respondents AUG, CYNNY, H.T.I.E., Houghes, and respondents A.R.E., Multi-Trend, Harvard, High End, and NEOCO. (FF 241).[38] Complainants' Panchanathan and Guruswamy either performed or had others perform under their direction or supervision chemical composition tests, magnetic properties tests, X-ray diffraction tests, and scanning electron microscopy (SEM) tests on respondents' and former respondents' magnets to determine whether they satisfied all the elements of the asserted claims of the magnet patents. (FF 246-263).[39]

In addition, complainants also obtained headphones made by third-party AIWA and a

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[38] Although Respondents Xin Huan and Jing Ma did not submit sample magnets in discovery, they are related to other former respondents. {

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[39] The chemical composition and magnetic properties tests were specifically performed by Magnequench at the request of complainants' Panchanathan. (FF 247). The X-ray diffraction and SEM tests were performed by, or under the direct supervision of, complainants' Guruswamy. (FF 258, 262). Hereinafter, each of the chemical composition, magnetic properties, X-ray diffraction and SEM tests will be referred to as complainants' tests.

microphone made by third-party GEC.[40] The magnets were removed from those products and chemical analysis and magnetic property tests were performed on them at Magnequench. (FF 244).

Respondent NEOCO sent samples of its own magnets (including Sample B Magnets) to a laboratory in Ames, Iowa for testing. (FF 265). The Ames Laboratory did tests to determine certain characteristics of NEOCO's Sample B magnets, such as their chemical composition and magnetic properties.

The results of complainants' tests are set forth in (FF 264). The result of the Ames laboratory tests are set forth in RXN-72 and RXN-66. With respect to complainants' chemical composition tests, NEOCO argued that said tests were performed by Magnequench and as such the results may be influenced by existing bias (NPost at 104); that Magnequench did not verify its test results through a backup chemical testing laboratory (NPost at 104); that Magnequench used up to six people to conduct the tests and this may have introduced inconsistency and error into the results (NPost at 104-105); that the test results were later corrected for "drift" (NPost

[40] While complainants offered evidence of the existence of infringing magnets in GEC and AIWA imported products, the administrative law judge can find no evidence in the record concerning the corporate entities identified by complainants as "GEC" and "AIWA." However, on September 2, 1999 the administrative law judge visited the "GEC Home Page" at http://www.GEC.com/index.htm, which represented that "GEC" is the General Electric Company, p.l.c. headquartered in London, at the following address: One Bruxton Street, London, U.K. W1X 8AQ. Also, on September 2, 1999, the administrative law judge visited the "AIWA Company Background" page at http://www.aiwa.com/compback.htm, which represented that "AIWA" is AIWA America, Inc. headquartered in New Jersey at the following address: 800 Corporate Drive, Mahwah, NJ 07430. Based on the foregoing, the administrative law judge takes official notice of the above information concerning third parties GEC and AIWA.

at 105); and that as a result said tests are inaccurate and imprecise. (NPost at 104-105).[41]

While NEOCO has challenged complainants' chemical composition tests, during the hearing the parties stipulated that:

> the magnets tested were tested according to scientific methods acceptable for expert analysis, though the precise means of testing may be challenged, based on expert testimony.

(Tr. at 84) (Emphasis added). Thus, NEOCO agreed, during the hearing, that complainants' tests were conducted according to methods acceptable for expert analysis. Moreover, NEOCO has not offered any expert testimony or other evidence to show that a bias has influenced the tests performed by complainants at Magnequench, or that failure to conduct a backup tests renders the chemical composition results unreliable. In addition, NEOCO has offered no expert testimony or pointed to any evidence that shows that the use of six or more people to conduct the tests could introduce an inconsistency, or that correcting results for "drift" is improper and renders complainants' results inaccurate. Based on the foregoing, the administrative law judge rejects NEOCO's argument that complainants' chemical composition tests are inaccurate.

NEOCO, referring to a comparison of the Ames results (RXN 72 and RXN 66) and complainants' chemical composition results for the NEOCO sample (FF 264) which shows:

	Ames	Magnequench
Nd	14.7+/-.o.3	16.5959
Fe	62+/-5	66.7650
B	0.94+/.11	1.1270
Co	0.005+/-.002	0.0910

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[41] Aside from NEOCO's arguments concerning complainants' chemical composition tests, NEOCO did not challenge any of the other tests conducted by complainants, for example the magnetic property tests, the x-ray diffraction tests or the scanning electron microscopy tests.

Sm	0.1528+/-.002	0.0000
Ni	0.49+/-0.01	0.0
P	0.0431+/-	0.0
La	ND[42]	0.0880
Al	ND	0.4360
O	ND	0.7466

argued that the results of tests performed by Ames laboratory on a similar magnet tested by complainants differ "significantly" from the results obtained by the complainants. (RROCFF-229). Specifically, NEOCO argued that the differences in the wt% results reflected above are "major differences" and that, as a result of those differences, complainants' tests are unreliable. (Tr. at 2278 and RROCFF 229, NPost at 105-106). NEOCO also argued that complainants' chemical composition tests are inaccurate because the results for several of the elements are 0.000. (For example, there are 3 results of 0.000 for the element Sm). (RROCFF-243, Tr. at 2293-2294, see also FF 264).

Gallup, in his witness statement, testified that Larry Jones of the Ames Laboratory, in a telephone conversation, told Gallup that he (Jones) "found it very hard to imagine that their (complainants') testing was so precise that they could carry it out 4 decimal places and also provide no margin of error." (RXN-96, Q&A 30). However, RXN-72 includes a letter from Larry Jones, of the Ames laboratory, to Gallup which addresses the differences that occurred between the two chemical composition tests. Jones explains the differences between complainants' tests and the Ames tests and states "[d]ifferences most likely arise due to differences in the analysis standards/calibrations and differences in the samples analyzed." Jones then concludes "[t]he result of the comparison by Dr. McCallum revealed that essentially the test

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[42] ND refers to "not detected."

results support each other." (RXN-72). Thus, despite Gallup's testimony, the administrative law judge finds that the evidence indicates that Jones concluded that complainants' tests were supported by the Ames laboratory tests.

In addition, Gallup testified that the differences between complainants' tests and the Ames' tests were "unusual" and "questionable." (RXN-96, Q&A 34). Gallup, however, was not qualified as an expert in chemical composition or testing, nor did he submit any expert report on the subject of chemical composition testing by complainants and Ames. Thus, while the test results do differ, NEOCO has provided no expert testimony to show that such differences are evidence that complainants' tests are unreliable. Moreover, while many of the elements tested for by complainants do achieve a result of 0.000, NEOCO entered into a stipulation concerning the method of testing done by both complainants and NEOCO. Based on the foregoing, and in view of the stipulation entered into by the parties, the administrative law judge rejects NEOCO's argument that, based on the differences between complainants' chemical composition tests and the Ames laboratory's tests, complainants' chemical composition tests are unreliable.

The administrative law judge further rejects NEOCO's argument that because the results of the chemical composition test on NEOCO's sample magnet resulted in the most "out of limit flags," NEOCO's sample magnet is the most dissimilar of all the magnets tested, and therefore NEOCO's magnets are somehow non-infringing. (Tr. at 2287, NFF-266). Stephen Barr, who directly supervised the chemical composition tests on certain of respondents' magnets (FF 247), testified concerning the meaning and significance of the terms "flags" and "out of limits" reported for certain elements in the results of the chemical composition analysis done by complainants. Specifically, Barr testified that:

> The computer software used at Magnequench to analyze the ICP test data includes a feature that compares the weight percent of each element being tested with a standard range of values for that element set for a particular Magnequench commercial product. If the weight percent of the element tested falls outside this standard range of values for the Magnequench commercial product, the test result will indicate "Out of Limits" in the "Flag" column. This feature was created, and is used by Magnequench, for internal quality control purposes; it is not relevant for any tests performed on non-Magnequench products. It is listed in the test results of the respondents' magnets simply because the same computer software was used.

(CX-73, Q. 19) (Emphasis added). Furthermore, Guruswamy testified that any "[f]lags" or "out of limits" reported on the chemical analysis tests have nothing to do with the analysis of whether magnets of respondents infringe the asserted claims of the patents in issue. (Tr. at 272). Also, NEOCO has pointed to no testimony, expert or otherwise, in the record that shows that the "out of limits" results in the "flag" column in the chemical composition test renders NEOCO's magnet non-infringing.

The administrative law judge in addition rejects NEOCO's argument that because the chemical composition tests do not "indicate if the chemical results were expressed in wt%, normalized% or atomic%," any conclusions drawn by Guruswamy are questionable. (RROCFF-233, Tr. at 2290). To the contrary, the test results for the chemical composition tests in CX-49 are expressed in each of wt%, normalized% and atomic% and Guruswamy's testimony concerning those results clearly refers to CX-49. (Tr. at 623-646).

Based on the foregoing, the administrative law judge finds that all of complainants' tests performed on the magnets of respondents, former respondents and third parties are accurate and reliable.

B. Magnequench Patents

1. Rapid Solidification Or Melt Spinning

NEOCO argued that it does not infringe each of the asserted claims of the Magnequench patents.[43] It is argued that the specifications of the Magnequench patents teach melt spinning to create a magnetically hard alloy; that there is no mention of sintering in the asserted claims of the Magnequench patents; that patentee Croat confirmed that the "only" process for making magnets described in the Magnequench patent specifications is melt spinning; and that while the asserted claims, as properly interpreted, only cover rapidly quenched alloys (NPost at 55-62), NEOCO's magnets are sintered and not rapidly quenched. (NPost at 69, 106).

Contrary to NEOCO's arguments, the asserted claims of the Magnequench patents contain no process limitations, and are specifically drawn to particular compositions.[44] A "true" product claim is one in which the product is defined in terms of structural characteristics only. See Chisum On Patents §8.05. It is well established than an inventor may claim a new

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[43] NEOCO was the only respondent that filed a prehearing statement, participated in the hearing, filed posthearing submissions and participated in closing arguments. Respondents A.R.E., Jing Ma, Xin Huan and Multi-Trend have been found in default, and thus have waived their right to appear, be served with documents and contest the allegations at issue in this investigation. See Procedural History supra. While respondents High End and Harvard responded to the complaint and notice of investigation with denials of the allegations in issue, neither High End nor Harvard filed any prehearing submission, including exhibits, participated in the hearing nor filed any post hearing submissions nor participated in closing argument. Therefore High End and Harvard have presented no evidence to support their denials or refute the evidentiary record at the hearing.

[44] The specification of the '395 patent does state that the key to practicing the invention is to quench particularly a rare earth-iron alloy at a specific rate. (FF 24). However the specification of the '058 patent discloses that while melt spinning is a preferred method of making the subject boron enhanced RE-TM magnet materials, other comparable methods may be employed. (FF 37).

and useful compound without limiting the claim to the method for making or using that compound. Id. §5.04(6). See also SRI Int'l v. Matsushita Electric Corp., 775 F.2d 1107, 1112 (Fed. Cir. 1985). A product claim is infringed by any product that contains every claim limitation recited therein, regardless of how that product is made. Exxon Chemical Patents, Inc. v. Lubrizol Corp., 64 F.3d 1553, 1557 n.4 (Fed. Cir. 1995), cert. denied, 518 U.S. 1020 (1996), on later appeal, vacating and remanding denial of motion for new trial, 137 F.3d 1475 (Fed. Cir. 1998) (Exxon).

NEOCO argued that the claims, as properly interpreted, only cover rapidly quenched alloys. Process limitations are found in product-by-process claims not in issue of the Magnequench patents.[45] However none of the asserted claims recites any limitations regarding the manner in which the claimed compositions are made. Thus, since the asserted claims of the Magnequench patents are specifically drawn to particular compositions, they should not be read as product by process claims. See Exxon, 64 F.3d at 1557.

NEOCO relies on Gentry Gallery, Inc. v. Berkline Corp., 134 F.3d 1473, 45 U.S.P.Q.2d 1498 (Fed. Cir. 1998) (Gentry Gallery) to support its argument that rapid quenching should be read into the asserted claims. The Federal Circuit however, in Johnson Worldwide Associates, Inc. v. Zebco Corporation, 175 F.3d 985 (Fed. Cir. 1999) (Johnson), held that a court must presume that the plain language of a claim's language is what applies, and that there must be a compelling reason for a court to give the language of the claim something other than its ordinary and accustomed meaning. Id. at 989. In Johnson the

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[45] See,e.g.,claims 11, 13, 17 of the '931 patent (CX-2) and claims 2, 3, 6, 10 of the '058 patent. (CX-1).

Federal Circuit stated that there is a "heavy presumption" in favor of the ordinary meaning of the claim, and a patent's written description and prosecution history cannot be used to narrow claims "unless the language of the claims invites references to those sources." Id.at 989-90 (Emphasis added). The administrative law judge finds that the asserted claims of the Magnequench patents have not invited reference to the specifications.

Based on the foregoing, the administrative law judge finds that the asserted claims of the Magnequench patents should not be limited to compositions which are prepared by a rapid quenching process.

2. The '058 Patent

Complainants argued that they have shown that respondents, viz. NEOCO, AUG, CYNNY, H.T.I.E., Houghes, Multi-Trend, Harvard, High End and A.R.E. have infringed each of independent claims 1, 4, 5, 8, 9 and 11 of the '058 patent. (CPost at 20-25). The staff argued that all of the respondents, viz. Houghes, IMI, Multi-Trend, AUG, Harvard, High End, H.T.I.E., CYNNY, A.R.E., NEOCO, Jing Ma and Xin Huan, have infringed each of independent claims 1, 4, 5, 8, 9 and 11 of the '058 patent. (SPost 11-15).[46]

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[46] Both the complainants and the staff have repeatedly included the former respondents, H.T.I.E., Houghes, A.U.G., CYNNY and I.M.I. in their infringement analysis of the six patents in issue. However, those former respondents have been terminated from the investigation. Moreover, SSMC's counsel acknowledged that the former respondents are out of the investigation and that they are not part of, and should be excluded from, any general exclusion order that may issue. (Tr. at 2100). In view of the fact that each of said former respondents has been terminated from the investigation, the administrative law judge will not address said former respondents in his infringement analysis of the six patents in issue. However, as noted supra,
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Independent claims 1, 4, 5, 8, 9 and 11 of the '058 patent are in issue in this investigation. (FF 42). The plain language of claim 1 describes a magnetically hard alloy comprised of (1) neodymium, praseodymium or a mixture thereof, (2) iron, and (3) boron, each in a certain atomic percentage that can vary. (FF 41).

Claim 4 claims an alloy composition comprised of one or more of any of the rare-earth elements, including the "neodymium, praseodymium or mixtures thereof" limitation set forth in claim 1, "at least" about 0.5 atomic percent boron, and iron within the same range of atomic percentages set forth in claim 1. (FF 42). Claim 4 also calls for the composition to have a coercivity of 5000 Oersteds at room temperature. Id.

Claim 5 is similar to claim 4 in that it claims an alloy composition with atomic percentages of the rare-earth elements and boron of claim 4 falling within the same range of values as in claim 4. (FF 43). The presence of the boron must increase the composition's Curie temperature with respect to a "like alloy" containing substantially no boron.[47] (FF 43). Claim 5 also calls for the composition to include up to about 90 atomic percent of one or more of iron, nickel, and cobalt, with iron comprising at least about 50 percent of the composition. In addition, the composition claimed in claim 5 must have a coercivity of at least about 1000 Oersteds at room temperature. Id.

Claim 8 of the '058 patent discloses a formula for a hard magnet alloy. Specifically, it

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[47] Figures 1, 2 and 4 of the '058 patent illustrate how the presence of boron increases the coercivity of a neodymium/praseodymium - iron compound.

claims a composition "consisting essentially" of the formula $RE_{1-x}(Fe_{1-y}B_y)_x$[48] where RE is one or more rare-earth elements consisting of praseodymium, neodymium, or mixtures thereof, "Fe" is iron, and B is boron. (FF 44). The value of y can vary between about 0.01 and 0.10. Thus, the amount of boron present in the claimed composition must be between 1 and 10 atomic percent based on the amount of iron and boron present in the composition. The value of x can vary between about 0.5 to about 0.9. Id. Hence, the amount of the rare earth constituent of the claimed composition is between 10 and 50 atomic percent of the total composition, and the amount of the iron-boron constituent is between 50 and 90 atomic percent of the total composition. The value of x times (1-y) must be greater than or equal to 0.5. Id.

Claim 9 covers a magnetically hard alloy composition with a coercivity of at least about 1000 Oersteds and comprising (1) from about 10 to about 40 atomic percent of one or more rare earths from a recited list wherein the neodymium and/or praseodymium comprise at least 10 atomic percent of the total composition; (2) one or more transition metals including at least about 50 to 90 atomic percent iron; and (3) at least about 0.5 atomic percent boron. (FF 45).

Finally, claim 11 covers a magnetically hard composition comprised of (1) one or more rare-earth elements including at least about 10 to about 40 atomic percent neodymium and/or praseodymium; (2) one or more transition metals including at least about 50 to 90 atomic percent iron; and (3) more than about 0.5 atomic percent boron. In addition, the composition

[48] The formula recited in claim 8 uses an "F" rather than an "Fe" to represent iron. The evidence adduced at trial demonstrates that a person of ordinary skill in the art would understand this to be a typographical error. (Guruswamy, Tr. at 360).

covered by claim 11 has a coercivity of at least about 5000 Oersteds and a remanence of at least about 4000 Gauss at room temperature. (FF 46).

Referring to the tests conducted on NEOCO's sample magnet by complainants and the tests conducted on NEOCO's sample B magnet by the Ames laboratory, with respect to claim 1 of the '058 patent and the NEOCO magnet tested by complainants, the administrative law judge finds that said magnet has the following characteristics which are within the literal language of claim 1: (i) its intrinsic coercivity (13,200 Oersteds) exceeds 1,000 Oersteds, and thus it is a magnetically hard alloy composition as defined in the specification of the '058 patent; (ii) it contains a total amount of neodymium and praseodymium of about 14 atomic percent, which exceeds the claim requirement of at least about 10 atomic percent; (iii) it contains about 74.46 atomic percent of iron, which lies within the claimed range from at least about 50 to about 90 atomic percent iron; and (iv) it contains 6.49 atomic percent boron, which lies within the range from about 0.5 to 10 atomic percent boron set forth in the claim. (Guruswamy, Tr. at 322-24; CX-49, Tab17; CX-51; CX-71, Tab1 at 3).

Also, with respect to the NEOCO sample B magnet, tested by Ames laboratory, NEOCO's expert Bohlmann testified that said magnet satisfies all the elements of claim 1 of the '058 patent. (Bohlmann, Tr. at 1708, 1710-11, 1712, 1713; CX-1, col. 4, lines 13-15).

Based on the foregoing the administrative law judge finds that complainants have met their burden in establishing that NEOCO infringes claim 1 of the '058 patent.

With respect to claim 1 of the '058 patent and the sample magnets of the other respondents, viz. Multi-Trend, Harvard (samples A, B, and C), High End (samples D, E, F, G, H, and I), A.R.E., Xin Huan, and Jing Ma [49] the administrative law judge finds that each of the magnets has: (i) a coercivity value in excess of 1,000 Oersteds, and thus is a "magnetically hard alloy composition," as defined in the '058 patent; (ii) a total amount of neodymium and praseodymium, which lies within the claimed range from at least about 10 to about 40 atomic percent; (iii) an iron content, which lies within the claimed range from at least about 50 to about 90 atomic percent; and (iv) a boron content that lies within the claimed range from about 0.5 to 10 atomic percent. (Guruswamy, Tr. at 327, 329-30; CX-49, Tabs 1-16; CX-51; CX-71, Tab 1).

Based on the foregoing the administrative law judge finds that complainants have sustained their burden in establishing that Multi-Trend, Harvard, High End, A.R.E., Jing MA and Xin Huan infringe claim 1 of the '058 patent.

Regarding each of independent claims 4, 5, 8, 9 and 11 of the '058 patent, the administrative law judge finds that the NEOCO sample magnet, tested by the complainants, has the following characteristics: (i) it is a "magnetically hard alloy composition" or "hard magnet," as defined in the '058 patent and recited in the claims, because its intrinsic coercivity (13,200 Oersteds) exceeds 1,000 Oersteds; (ii) its intrinsic coercivity also exceeds the minimum level of 5,000 Oersteds set forth in claims 4 and 11; (iii) its remanence value of 11,800 Gauss exceeds the minimum of 4,000 Gauss set forth in claim 11; (iv) it contains a total of about 14 atomic percent of neodymium and praseodymium, which is within the range

[49] Henceforth, the magnets of the "other respondents " refers to the magnets of Multi-Trend, Harvard (samples A, B, and C), High End (samples D, E, F, G, H, and I), A.R.E., Jing Ma, and Xin Huan.

from at least about 10 to about 40 atomic percent, as set forth in the claims; (v) it contains about 74.46 atomic percent of iron, which is within the claimed range from at least about 50 to about 90 percent; and (vi) it contains about 6.49 atomic percent of boron, which lies within the claimed range from about 0.5 to 10 atomic percent. (Guruswamy, Tr. at 343-45, 350-52; CX-49, Tab17; CX-51; CX-52; CX-71, Tabs 2-6).

In addition, with respect to claim 5 of the '058 patent, the administrative law judge finds that NEOCO's magnet, tested by complainants, contains boron, which serves to "increas[e] its Curie temperature with respect to like alloy containing substantially no boron," as required by the claim. (CX-1, col. 12, lines 28-30; Guruswamy, Tr. at 349-50; CX-49, Tabs 17; CX-71, Tab 3). Also, with respect to claim 8, the administrative law judge finds that the content of NEOCO's magnet satisfies the chemical formula $RE_{1-x}(F_{1-y}B_y)_x$ set forth in that claim. In particular, NEOCO's magnet contains iron, boron and neodymium and/or praseodymium in amounts that fall within the ranges stated for "x" and "y" in claim 8. (Guruswamy, Tr. at 345; CX-49, Tab 17; CX- 71, Tab 4).

Based on the foregoing, the administrative law judge finds that complainants have sustained their burden in establishing that NEOCO infringes claims 4, 5, 8, 9 and 11 of the '058 patent.

With respect to the magnets of the other respondents, the administrative law judge finds that each of said magnets has: (i) an intrinsic coercivity in excess of 1,000 Oersteds, and thus is a "magnetically hard alloy composition" or "hard magnet," as defined in the '058 patent; (ii) an intrinsic coercivity in excess of the minimum level of 5,000 Oersteds set forth in claims 4 and 11; (iii) a remanence value in excess of 4,000 Gauss, as set forth in claim 11; (iv) a total content of neodymium and praseodymium that falls within the claimed range from at least about 10 to about 40 atomic percent; (v) an iron content that falls within the claimed range from at least about 50 to about 90 percent; and (vi) a boron content that falls within the claimed range from about 0.5 to 10 atomic percent. (Guruswamy, Tr. at 344-45, 350-52; CX-49, Tabs 1-16; CX-51; CX-52; CX-71, Tabs 2-6).

In addition, with respect to claim 5 of the '058 patent, all of said magnets also contain boron which serves to "increas[e] its Curie temperature with respect to like alloy containing substantially no boron." (CX-1, col. 12, lines 28-30; Guruswamy, Tr. at 349-50; CX-49, tabs 1-17). Also, with respect to claim 8 of the '058 patent, each of said magnets contains amounts of neodymium and/or praseodymium, iron, and boron such that thus satisfy the chemical formula $RE_{1-x}(F_{1-y}B_y)_x$ set forth in that claim. (Guruswamy, Tr. at 345; CX-49, tabs 1-16; CX-71, Tab 4).

Based on the foregoing, the administrative law judge finds that complainants have met their burden in establishing that each of Multi-Trend, Harvard, High End, A.R.E., Xin Huan and Jing Ma infringe claims 4, 5, 8, 9 and 11 of the '058 patent.

3. The '931 Patent

Complainants argued that they have shown that the respondents, viz. NEOCO, AUG, CYNNY, H.T.I.E., Houghes, Multi-Trend, Harvard, High End and A.R.E., have infringed each of independent claims 1, 2, 3, 10, 14, 16, 18, 19 and 20 and dependent claims 4, 5, 6, and 15 of the '931 patent. (CPost at 25-30).

The staff argued that all of the respondents, viz. Houghes, IMI, Multi-Trend, AUG, Harvard, High End, H.T.I.E., CYNNY, A.R.E., NEOCO, Jing Ma and Xin Huan, have infringed each of claims of the '931 patent. (SPost at 15-20).

Independent claims 1, 2, 3, 10, 14, 16, 18, 19 and 20 and dependent claims 4, 5, 6, and 15 of the '931 patent are in issue. (FF 53). Claim 1 requires a permanent magnet in which the predominant phase is $(RE_{1-a}RE'_{a})_2(Fe_{1-b}TM_b)_{14}B_1$ wherein the amount of neodymium and praseodymium should be at least six percent of the total magnet. (FF 53). Other rare earth elements may be present, but only up to an amount equal to 40 atomic percent of the total of all rare earths in the composition. Id. Claim 1 also requires that iron comprise at least about 40 atomic percent of the claimed composition, and that the total of iron and other transition metals comprise at least 90 atomic percent of the claimed composition. Id. Finally, the claim requires boron in an amount ranging between about 0.5 to about 10 atomic percent of the composition and that the magnet has intrinsic magnetic coercivity of at least 1,000 Oersteds. Id.

The remaining asserted claims of the '931 patent claim are directed to magnets or magnetic compositions similar to what is described in claim 1 but with additional limitations. Claim 2 claims a permanent magnet with an energy product at magnetic saturation (also known as the "maximum energy product") of at least about 5 megaGaussOersteds, comprising at least 10 to about 40 atomic percent of one or more rare earth elements (with at least about 6 percent of the magnet consisting of neodymium and/or praseodymium), at least about 0.5 to 10 atomic percent boron; and at least about 50 to 90 atomic percent iron and/or iron-cobalt mixtures, with the cobalt in the mixture being less than about 40 percent of the iron. The predominant phase of the magnet claimed in claim 2 is $RE_2TM_{14}B_1$. (FF 54). Claim 3 covers a magnetically hard alloy composition comprising at least about 10 to about 40 atomic percent neodymium and/or praseodymium; boron in the same percentage range as in claim 2; up to 90 total atomic percent of one or more transition metal elements with iron being at least 40 atomic percent of the alloy; and with the same predominant phase as in claim 2. (FF 55). Claims 4 through 6 are dependent upon claim 3, each adding a different limitation to the composition claimed in claim 3. (FF 56-58).

Claim 10 covers a permanent magnet with a coercivity of at least about 1,000 Oersteds with the same limitations regarding the rare-earth and boron constituents as set forth in claim 2. (FF 59). The claimed magnet also has from zero to less than about 20 total atomic percent (based on iron in the alloy) of one or more of titanium, nickel, chromium, zirconium, and manganese. It also has the same limitation regarding transition metals (including a minimum amount of iron) set forth in claim 3, and the predominant magnetically hard constituent is the tetragonal crystal phase $RE_2TM_{14}B_1$. Id.

Claim 14 covers a "$RE_2TM_{14}B_1$ type" permanent magnetic alloy with a coercivity of at least about 5,000 Oersteds, and comprising at least about 10 to about 40 atomic percent neodymium and/or praseodymium, at least about 50 to about 90 atomic percent iron, at least about 0.5 to about 10 atomic percent boron, and up to about 20 atomic percent (based on the neodymium and praseodymium) of one or more heavy rare-earth elements. (FF 60). Claim 15 depends on claim 14 and states that the heavy rare-earth element is terbium and/or dysprosium. (FF 61).

Claim 16 covers a permanent magnet composition with a coercivity of at least about 1,000 Oersteds and comprised predominantly of the tetragonal crystal phase $RE_2TM_{14}B_1$ with the atomic percent values of the rare earth elements (RE), transition metal elements (TM) and boron falling within prescribed ranges. (FF 62). Claim 18 covers a permanent magnet composition with a coercivity of at least about 1,000 Oersteds in which the predominant phase is $RE_2(Fe_{1-x}Co_x)_{14} B_1$ with the rare earth elements, iron, cobalt and boron falling within prescribed ranges. (FF 63).

Claim 19 covers a permanent magnet alloy in which the predominant phase is $RE_2(Fe_{1-x}TM_x)_{14}B_1$ and also has a tetragonal crystal structure. The c-axis of the crystal is the preferred axis of magnetization, and the lengths of the c-axis and a-axis are about 12.2 angstroms and 8.78 angstroms respectively. (FF 64). The atomic percent values of the rare-earth elements, transition elements, iron and boron fall within prescribed ranges. Id.

Claim 20 covers a permanent magnet alloy in which the predominant phase is $RE_2Fe_{14-x}TM_xB_1$ which has a tetragonal crystal structure with the c-axis being the preferred axis of magnetization. (FF 65). The atomic percent values of the rare-earth elements, transition elements, iron and boron fall within prescribed ranges. Id.

Regarding claim 1 of the '931 patent, the administrative law judge finds that the NEOCO sample magnet, tested by complainants, contains a total of about 14 atomic percent of neodymium and praseodymium, which exceeds the minimum level of 6 atomic percent for neodymium and/or praseodymium stated in claim 1. (Guruswamy, Tr. at 378-79; CX-49, Tab17; CX-71, Tab 7). NEOCO's magnet also contains a total of about 0.65 atomic percent of other rare-earth elements, viz., gadolinium, dysprosium, lanthanum, cerium, and samarium, which are among the elements listed for RE' in claim 1. (Guruswamy, Tr. at 378-80; CX-49, Tab 17). That amount, plus the about 14 atomic percent neodymium and praseodymium, means that the total amount of rare-earth elements in the NEOCO magnet is about 14.7 atomic percent, which is less than the maximum value of 40 atomic percent of rare-earth elements stated in claim 1 of the '931 patent. (Guruswamy, Tr. at 380-81, 385; CX-49, Tab 17; CX-71, Tab 7). Dividing the amount of RE' (0.65 atomic percent) by the amount of total rare-earths (14.7 atomic percent) yields a value of about 0.04, which is within the range of 0 to about 0.4 given for "a" (from 0 to about 0.4) stated in claim 1 of the '931 patent. (Guruswamy, Tr. at 380-81, 385).

The administrative law judge also finds that the NEOCO sample magnet tested by complainants contains 74.46 atomic percent iron (Fe), which is greater than the minimum level of about 40 atomic percent Fe stated in the claim and thus satisfies that claim element. (Guruswamy, Tr. at 392-93; CX-49, Tab 17; CX-71, Tab 7). The NEOCO magnet also contains cobalt and manganese, which are among the transition metals (TM) set forth in claim 1 of the '931 patent. (Guruswamy, Tr. at 780-81; CX-49, Tab 17; CX-71, Tab 7). The total concentration of iron and other transition metals in the NEOCO magnet is 74.74 atomic percent, which is less than the maximum amount of about 90 atomic percent for "Fe and TM" set forth in the claim. (Guruswamy, Tr. at 393; CX-49, Tab 17; CX-71, Tab 7). Moreover, dividing the amount of "TM" elements (0.26 atomic percent) by the total amount of transition metals (74.74 atomic percent) yields a value of about 0.003, which is within the range of 0.0-0.4 given for "b" (from about 0 to about 0.4) stated in claim 1. (Guruswamy, Tr. at 382; CX-49, Tab 17; CX-71, Tab 7).

The administrative law judge further finds that the NEOCO magnet tested by complainants contains 6.494 atomic percent boron, which is within the range of about 0.5 to 10.0 atomic percent required by claim 1 of the '931 patent. (Guruswamy, Tr. at 393; CX-49, Tab 17; CX-71, Tab 7). NEOCO's magnet also has an intrinsic coercivity of about 13,200 Oersteds and thus is a "permanent magnet," which is understood in the art to mean a magnet that has an intrinsic coercivity in excess of 1,000 Oersteds. (Guruswamy, Tr. at 368-69, 377; CX-49, Tab 17; CX-51). Also the X-ray diffraction tests show that the predominant phase of NEOCO's sample magnet tested by complainants is the "2-14-1 phase," i.e., 2 atoms of rare-earth elements (e.g., neodymium and/or praseodymium); for every 14 atoms of iron and 1 atom of boron, as required by claim 1 of the '931 patent. (Guruswamy, Tr. at 364, 377-78; CX-49, Tab 17; CX-71, Tab 7).

Moreover, NEOCO's expert Bohlmann testified that the NEOCO Sample B magnet, which NEOCO sent to Ames Laboratory for testing, satisfies all the elements of claim 1 of the '931 patent. (Bohlmann, Tr. at 1713-14; RXN-72). Bohlmann testified that the NEOCO Sample B magnet has: (i) about 14 atomic percent rare-earth elements (RE and RE' together), which is comprised predominantly of neodymium and praseodymium, which satisfies the claim requirement that RE is at least about 6 atomic percent and RE and RE' together comprise up to about 40 atomic percent of the magnet; (ii) about 6.2 atomic percent boron, which is within the claimed range from about 0.5 to 10 atomic percent; (iii) about 80 atomic percent iron, which satisfies the requirement that iron is at least about 40 atomic percent, and that transition metals as a whole comprise up to about 90 atomic percent of the magnet; (iv) an intrinsic coercivity in excess of 13,000 Oersteds and thus is a "permanent magnet," a term that is understood in the art as a magnet having a minimum coercivity of 1,000 Oersteds; and (v) the predominant phase is the 2-14-1 phase (or $(RE_{1-a}\,RE'_a)_2\,(Fe_{1-b}TM)_{14}B_1$ phase in the claim). (Bohlmann, Tr. at 1708, 1710-14).

Based on the foregoing, the administrative law judge finds that complainants have sustained their burden in establishing that NEOCO infringes claim 1 of the '931 patent.

With respect to claim 1 of the '931 patent and the magnets of the other respondents, the administrative law judge finds that each of said magnets has the $(RE_{1-a}RE'_a)_2(Fe_{1-b}TM_b)_{14}B_1$ predominant phase recited in claim 1 of the '931 patent. (Guruswamy, Tr. at 395; CX-49, Tabs 1-16). The administrative law judge also finds that each of respondents' and former respondents' magnets has: (i) a total amount of neodymium and/or praseodymium (RE) of about 12-14 atomic percent, which exceeds the claim minimum of about 6 atomic percent; (ii) a total rare-earth concentration (RE and RE' together) of about 14-15 atomic percent, which is less than the claim maximum of about 40 atomic percent; (iii) a boron (B) concentration of about 5.7-7.4 atomic percent, which lies within the range of about 0.5 to 10.0 atomic percent in the claim; (iv) an iron concentration of about 71-77 atomic percent, which is more than the claim minimum of about 40 atomic percent; and (v) a total concentration of iron and other transition metals (TM) of about 73-78 atomic percent, which is less than the claim maximum of about 90 atomic percent. (Guruswamy, Tr. at 395; CX-49, Tabs 1-16; CX-71, Tab 7).

The administrative law judge further finds that the X-ray diffraction tests show that the predominant phase in each of said magnets is the "2-14-1" phase. (Guruswamy, Tr. at 396; CX-49, Tabs 1-16; CX-71, Tab 7). Also, each of said magnets has an intrinsic coercivity in excess of 1,000 Oersteds, as required by claim 1. (Guruswamy, Tr. at 395; CX-51; CX-71, Tab 7).

Based on the foregoing, the administrative law judge finds that complainants have met their burden in establishing that each of Multi-Trend, Harvard, High End, A.R.E., Jing Ma and Xin Huan infringes claim 1 of the '931 patent.

With respect to claims 2-6, 10, 14-16, and 18-20 of the '931 patent, the administrative law judge finds that each of respondents' magnets, including NEOCO's, contains neodymium, praseodymium, iron, boron, and other transition metals in amounts that fall within the various ranges set forth in each of claims 2-6, 10, 14-16, and 18-20 of the '931 patent. (Guruswamy, Tr. at 409; CX-49, tabs 1-17; CX-71, Tabs 8-20). Also, each of respondents' magnets, including NEOCO's, contains a heavy rare-earth element, namely dysprosium, as required by claims 4, 14, and 15 of the '931 patent. (Guruswamy, Tr. at 410; CX-49, Tabs 1-17). The inclusion of that heavy rare-earth element increases the intrinsic coercivity of the magnets, as required by claim 4. (Guruswamy, Tr. at 410).

The administrative law judge further finds that each of the respondents' magnets, including NEOCO's, has an intrinsic coercivity in excess of 5,000 Oersteds, as required by claims 5 and 14. (CX-51; CX-71, Tabs 10, 12). Therefore each of respondents' magnets, including NEOCO's, has an intrinsic coercivity in excess of 1,000 Oersteds, as required by claims 10, 16, and 18. Furthermore, each of respondents' magnets, including NEOCO's, is a "magnetically hard alloy composition," "permanent magnet," "permanent magnet composition" or "permanent magnet alloy," as recited in each of claims 2-6, 10, 14-16, and 18-20, because those terms are defined or understood in the art as requiring a minimum coercivity of 1,000 Oersteds. (Guruswamy, Tr. at 411-12; CX-49, Tabs 1-17; CX-71, Tabs 8-17).

The administrative law judge, in addition, finds that all of respondents' magnets, including NEOCO's, have maximum energy products in excess of 10 megaGaussOersteds and thus satisfy the energy product requirements recited in claims 2 and 5 of the '931 patent. (Guruswamy, Tr. at 412-13; CX-49, Tabs 1-17; CX-53). Also, all of respondents' magnets, including NEOCO's, have remanence values in excess of 7 million GaussOersted (i.e., 7 megaGaussOersteds), and thus satisfy the remanence requirement of claim 6 of the '931 patent. (Guruswamy, Tr. at 413-14; CX-52).

The administrative law judge also finds that the X-ray diffraction tests show that the predominant phase in each of respondents' magnets, including NEOCO's, is the $RE_2TM_{14}B_1$ phase, as required by claims 2-6, 10, 14-16, and 18-20 of the '931 patent. (Guruswamy, Tr. at 414; CX-49, Tabs 1-17; CX-71, Tabs 8-17). Also, the X-ray diffraction tests further show that the predominant $RE_2TM_{14}B_1$ phase in each of respondents' and former respondents' magnets, including NEOCO's, has a tetragonal shape, as required by claims 10, 16, 19, and 20. (Guruswamy, Tr. at 414-15; CX-71, Tabs 11, 14, 16, 17).

In addition the administrative law judge finds that the preferred axis of magnetization in each of respondents' magnets, including NEOCO's, is the crystallographic c-axis, as required by claims 19 and 20 of the '931 patent. (Guruswamy, Tr. at 415-16; CX-71, Tabs 16, 17). Also, in each of respondents' magnets, the length of the crystallographic c-axis is about 12.2 angstroms, and the length of the a-axis is about 8.78 angstroms, as required by claim 19 of the '931 patent. (Guruswamy, Tr. at 416-18; CX-49, Tabs 1-17; CX-71, Tab 16).

Based on the foregoing, the administrative law judge finds that complainants have met their burden in establishing that each of NEOCO, Multi-Trend, Harvard, High End, A.R.E., Jing Ma and Xin Huan infringe claims 2-6, 10, 14-16, and 18-20 of the '931 patent.

4. The '395 Patent

Complainants have argued that they have shown that respondents NEOCO, AUG, CYNNY, H.T.I.E., Houghes, Multi-Trend, Harvard, High End and A.R.E. have infringed each of independent claims 13-18 of the '395 patent. (CPost at 31-33). The staff argued that all of the respondents, viz., Houghes, IMI, Multi-Trend, AUG, Harvard, High End, H.T.I.E., CYNNY, A.R.E., NEOCO, Jing Ma and Xin Huan infringe claims 13-18 of the '395 patent. (SPost at 7-10).

Independent claims 13, 14, 15, 16, 17 and 18 of the '395 patent are in issue. (FF 26). The plain language of claim 13 describes a permanent magnet alloy made of iron and neodymium and/or praseodymium with a coercivity of at least 5000 Oersteds at room temperature. (FF 26). Each of the other asserted independent claims of the '395 claim magnets or magnetic alloys with an inherent intrinsic magnetic coercivity of at least 5000 Oersteds at room temperature. (FF 27-31). Claim 14 essentially claims the same compound as claim 13 but with the added limitation that the compound be at least 50 atomic percent iron. (FF 27). Claim 15 claims the same compound as claim 14 with the additional limitation that the magnet have a "magnetic ordering temperature" of 295° K. (FF 28). Claim 16 covers a compound with the same coercivity, magnetic ordering temperature, and atomic percent iron properties as claim 15, but allows the rare-earth to be one or more of neodymium, praseodymium, "or mischmetals thereof." (FF 29). Claim 16 also allows the transition metal to be either iron or iron mixed with "a small amount" of cobalt. Id. Claim 17 claims a permanent magnet containing a "magnetic phase" based on one or more rare earth elements and iron, which phase has the same coercivity and magnetic ordering temperature characteristics as claims 15 and 16, with the rare earth elements (although the rare-earth constituent consists "predominantly" of neodymium and/or praseodymium). (FF 30). Finally, claim 18 covers a permanent magnet "based on" neodymium and iron with a phase which has the same coercivity and magnetic ordering temperature characteristics as claims 15, 16, and 17. (FF 31).

With respect to independent claim 13 of the '395 patent, the administrative law judge finds that the NEOCO sample magnet, tested by complainants, has an intrinsic coercivity of 13.2 kiloOersteds (i.e., 13,200 Oersteds) at room temperature, which is greater than the minimum level of 5,000 Oersteds at room temperature recited in claim 13 of the '395 patent. (Guruswamy, Tr. at 436; CX-49, Tab 17; CX-51; CX-72, Qs. 30, 31). Also, since the coercivity of NEOCO's magnet exceeds 1,000 Oersteds, NEOCO's magnet is a "permanent magnet" as it is understood in the art. (Guruswamy, Tr. at 433). The administrative law judge also finds that NEOCO's magnet contains iron, neodymium, and praseodymium, as required by claim 13 of the '395 patent. (Guruswamy, Tr. at 434; CX-49, Tab 17; CX-71, Tab 18).

Moreover, NEOCO's expert Bohlmann testified that NEOCO's Sample B magnet, which NEOCO sent to Ames Laboratory for testing, satisfies all the elements of claim 13 of the '395 patent. (Bohlmann, Tr. at 1714-15). Specifically, NEOCO's expert Bohlmann testified that NEOCO's Sample B magnets: (i) have an intrinsic coercivity in excess of 13,000 Oersteds, which exceeds the minimum level of 5,000 Oersteds stated in the claim; and (ii) contain iron, neodymium, and praseodymium. (Bohlmann, Tr. at 1708, 1710-11, 1712).

Based on the foregoing, the administrative law judge finds complainants have met their burden in establishing that NEOCO infringes claim 13 of the '395 patent.

NEOCO argued that it does not infringe each of claims 13, 14, 15, 16, 17 and 18. It is argued that the '395 patent is a binary patent; that claim 13 teaches a binary composition of one or more rare earths and iron; that each of claims 14, 15, 16 and 17 teaches a binary composition of one or more rare earths and iron; that those "alloys" are all prepared by melt-quenching; that none of the "patent specifications" describe the process to make sintered powder; and that NEOCO's magnets contain boron and are sintered. (NPost at 107-108).

NEOCO relies on the testimony of Bohlmann to support its argument that the claims of the '395 patent are limited to a "binary composition of one or more rare earths and iron" and that because NEOCO's magnets contain boron NEOCO does not infringe the '395 patent. However, when "comprising" is used as a transitional term in a patent claim, the scope of the claim does not exclude additional, unrecited elements. Genentech, Inc. v. Chiron Corp., 112 F.3d 495, 501, 42 U.S.P.Q.2d 1608, 1613 (1997) and Stiftung v. Renishaw PLC, 945 F.2d 1173, 1178, 20 U.S.P.Q.2d 1094 (Fed. Cir. 1991). Furthermore, the Federal Circuit, in A.B. Dick Co. v. Burroughs Corp., 713 F.2d 700, 218 U.S.P.Q. 965, cert. denied, 464 U.S. 1042 (1984), stated:

> It is fundamental that one cannot avoid infringement merely by adding elements if each element recited in the claims is found in the accused device. For example, a pencil structurally infringing a patent claim would not become non-infringing when incorporated into a complex machine that limits or controls what the pencil can write. Neither would infringement be negated simply because the patentee failed to contemplate use of the pencil in that environment.

Id. at 703, 967-968 (citation omitted). Based on the foregoing, the administrative law judge rejects NEOCO's argument that it does not infringe the claims of the '395 patent because its magnets have boron added to them.

As for the magnets of the other respondents, the administrative law judge finds that each of said magnets has the following characteristics: (i) it has an intrinsic coercivity in excess of 5,000 Oersteds, as required by claim 13 and thus it is a "permanent magnet alloy," which is understood in the art as requiring a coercivity in excess of 1,000 Oersteds; (ii) it contains iron; and (iii) it contains neodymium and/or praseodymium. (Guruswamy, Tr. at 438; CX-49, Tabs 1-17; CX-51; CX-71, Tab 18).

Based on the forgoing the administrative law judge finds that complainants have met their burden in establishing that each of Multi-Trend, Harvard, High End, A.R.E., Jing Ma and Xin Huan have infringed claim 13 of the '395 patent.

Regarding claims 14-18 of the '395 patent, the administrative law judge finds that all of respondents' magnets, including NEOCO's, satisfy the chemical composition requirements set forth in claims 14-16, in that they all contain: (i) more than 50 atomic percent iron; and (ii) neodymium and/or praseodymium. (Guruswamy, Tr. at 444-45, 447; CX-49, Tabs 1-17; CX-71, Tabs 19-23).

The administrative law judge also finds that all of respondents' magnets, including NEOCO's, satisfy the magnetic properties elements of claims 14-18, in that they all: (i) have intrinsic coercivity values in excess of 5,000 Oersteds at room temperature, as required by claims 14-18; (ii) are "permanent magnets," which is understood in the art as requiring a minimum coercivity of 1,000 Oersteds; (iii) have a magnetic ordering (Curie) temperature above about 295° K (required by claims 15-18); and (iv) have a magnetic phase (required by claim 17). (Guruswamy, Tr. at 445-48; CX-49, Tabs 1-17; CX-51; CX-71, tabs 19-23).

Based on the foregoing, the administrative law judge finds that the complainants have sustained their burden in establishing that each of NEOCO, Multi-Trend, Harvard, High End, A.R.E., Jing Ma and Xin Huan have infringed claims 14-18 of the '395 patent.

C. SSMC's Patents

1. The '723 Patent

Complainants have used the term "Group I Respondents" to refer to the magnets of former respondents AUG, CYNNY, H.T.I.E., and Houghes (sample A), and also to refer to the magnets of respondents Multi-Trend, High End (samples E-G and I), A.R.E. and NEOCO with respect to alleged infringement of the '723 patent. (CPost at 36). Complainants argued that each of Group I respondents' magnets infringes claim 2 of the '723 patent (CPost at 34-36); that each of the Group I respondents' magnets infringe claims 3-7, 9, 13-18, 20, 24-26 and 31 of the '723 patent (CPost at 36-38); that each of the magnets from CYNNY, H.T.I.E. and Houghes (sample A) infringes each of claims 8 and 19 of the '723 patent (CPost at 38-39); that the Multi-Trend and H.T.I.E. magnets infringe claim 34 of the '723 patent; that the Group I respondents' magnets infringe each of claims 27 and 33 of the '723 patent. (CPost at 39-41).

The staff argued that sample magnets from NEOCO, AUG, CYNNY, H.T.I.E., Houghes, Multi-Trend, High-End and A.R.E. fall within the literal limits of claim 2 (SPost at 24-27); that sample magnets from NEOCO, AUG, CYNNY, H.T.I.E., Houghes, Multi-Trend, High End and A.R.E. fall within the elements of claim 3 (SPost at 27); that complainants have failed to meet their burden that any of respondents' magnets infringe each of claims 13, 14, 15, 16, 17, 18, 19, 20, 25 and 26 of the '723 patent (SPost at 27-35); that the sample magnets from NEOCO, AUG, CYNNY, H.T.I.E. Houghes, Multi-Trend, High End and A.R.E. fall within the limits of claim 4 of the '723 patent (SPost at 31-32); that the sample magnets of NEOCO, AUG, CYNNY, H.T.I.E., Houghes, Multi-Trend, High End and A.R.E. fall within the limits of each of claims 5 and 6 (SPost at 32); that the sample magnets from each of NEOCO, AUG, CYNNY, H.T.I.E., Houghes, Multi-Trend, High End and A.R.E. fall within the scope of claim 7 (SPost at 33); that the sample magnets of CYNNY, H.T.I.E. and Houghes fall within the limits of claim 8 (Spost at 33-34); that magnets from CYNNY, H.T.I.E., Houghes, High End and A.R.E. infringe claim 31 of the '723 patent (SPost at 34-35); that sample magnets of H.T.I.E. magnets infringe claim 34 of the '723 patent (SPost at 35); and that the sample magnets of NEOCO, AUG, CYNNY, H.T.I.E., Houghes, Multi-Trend, High End and A.R.E. fall within the limits of claim 24. (SPost at 36).[50]

In issue are independent claims 2, 3, 13 and 14 and dependent claims 4, 5, 6, 7, 8, 9, 15, 16, 17, 18, 19, 20, 24, 25, 26, 27, 31, 33 and 34 of the '723 patent. (FF 106). The language of claim 2 is directed to a sintered anisotropic permanent magnet having an energy product in excess of 10 MGOe and containing: (i) between 12 to 20 atomic percent of one or more of the rare earth elements (R) listed in the claim, of which at least 50 atomic percent must be neodymium and/or praseodymium; (ii) between 4 and 24 atomic percent boron (B); and (iii) the balance being at least 56 atomic percent iron (Fe). (FF 107).

Claim 3 requires a sintered anisotropic permanent magnet having a mean crystal grain size of at least about 1 micron and having the same maximum energy product of claim 2 and consisting

[50] The staff further argued that NEOCO's expert Bohlmann testified that each of the asserted Sumitomo claims should be read to include the step of sintering in Argon. (SPost at 50). However, the staff did not cite to any transcript pages where Bohlmann gave such testimony. Moreover, NEOCO did not, in any of its posthearing submissions, raise the argument that the asserted claims of the Sumitomo patents should be read to include sintering in Argon.

of the same elements as required in claim 2, in which at least 50 vol % of the entire magnet is occupied by a ferromagnetic compound having a Fe-B-R type tetragonal crystal structure. (FF 108).

Claim 4 requires the permanent magnet of claim 3, which contains no less than 1 vol. % of nonmagnetic phases. (FF 109). Claim 5 requires a permanent magnet as defined in claim 2 or 3 in which Sm is no more than 2 atomic percent in the entire magnet. (FF 110). Claim 6 describes a permanent magnet as defined in claim 5, in which the mean crystal grain size is the range of from 2 to 40 microns. (FF 111).

Claim 7 describes a permanent magnet as defined in claim 2 or 3 in which Sm is no more than 2 atomic percent in the entire magnet. (FF 112). Claim 8 requires a permanent magnet as defined in claim 2 or 3, in which R is about 15 atomic percent, and b is about 8 atomic percent. (FF 113). Claim 9 requires a permanent magnet as defined in claim 2 or 3, in which the maximum energy product is no less than 20 MGOe. (FF 114).

Claim 13 requires a sintered anisotropic magnet with the same maximum energy product as that of claim 2 and consisting of the same elements as required in claim 2, with at least one additional element M select from the group listed in the claim in the amounts of no more than the atomic percentages specified in the claim, wherein the sum of M is no more than the maximum value of any one of the values specified in the claim for M actually added. (FF 115). Claim 14 describes a sintered anisotropic magnet having the same grain size and maximum energy product as required by claim 3. (FF 116). Claim 14 also consists of the same elements as claim 13 (including the M elements), and in which there is the Fe-B-R tetragonal crystal structure as described by claim 3. Id.

Claim 15 requires a permanent magnet as defined in claim 14, which contains no less than 1 vol. % of nonmagnetic phases. (FF 117). Claim 16 describes a permanent magnet as defined in claim 13 or 14, in which the mean crystal grain size is in the range from 1 to 90 microns. (FF 118). Claim 17 requires a permanent magnet as defined in claim 16, in which the mean crystal grain size is in the range from 2 to 40 microns. (FF 119).

Claim 18 describes a permanent magnet as defined in claim 13 or 14, in which Sm is no more than 2 atomic percent in the entire magnet. (FF 120). Claim 19 requires a permanent magnet as defined in claim 13 or 14, in which R is about 15 atomic percent, B is about 8 atomic percent. (FF 121). Claim 20 requires a permanent magnet as defined in claim 13 or 14, in which the maximum energy product is no less than 20 MGOe. (FF 122).

Claim 24 describes a sintered anisotropic permanent magnet as defined in claims 3 or 14 wherein said Fe-B-R type tetragonal crystal structure has the lattice constants a_0 of about 8.8 angstroms and c_0 of about 12 angstroms. (FF 123). Claim 25 requires a permanent magnet as defined in claims 13 or 14 wherein said additional elements M is at least one selected from the group consisting of V, Nb, Mo, W and Al. (FF 124). Claim 26 describes a magnet as defined in claim 25, wherein said additional elements M is contained no more than the amount by atomic percent as specified in the claim, and where the sum of M is no more than the maximum value of anyone of the values specified in the claim for M actually added. (FF 125).

Claim 27 requires a magnetic article in the form of powder compact of sintered mass of the magnetic material as defined in any of claims 1 and 12. [51] (FF 128). Claim 31 describes a sintered anisotropic permanent magnet as defined in claim 2, 3, 13 or 14, wherein R is Nd. (FF

[51] As stated in the Procedural History, Section I, supra, claim 12 has been withdrawn.

128). Claim 33 describes a magnetic article in the form of powder compact or sintered mass of the magnetic material as defined in claim 32.[52] [Claim 32 requires a magnetic material as defined in claim 1, 12, 24 or 30 wherein said Fe-B-R type tetragonal crystal structure has the lattice constants a_0 of about 8.8 angstroms and c_0 of about 12 angstroms. (FF 128)].

Claim 34 requires a magnet or material as defined in claim 1, 2, 3, 12, 14, 29 or 30 which is substantially Co-free. (FF 127).

a. claim 2

With respect to claim 2 of the '723 patent, the administrative law judge finds that the SEM test of NEOCO's sample magnet, tested by complainants' Guruswamy, shows that NEOCO's magnet is a sintered magnet and that the x-ray diffraction test, conducted by Guruswamy, shows that it is anisotropic, as required by claim 2 of the '723 patent. (Guruswamy, Tr. at 475-76; CX-49, Tab 17; CX-71, Tab 24). Furthermore, NEOCO's expert, Mr. Bohlmann, confirmed that NEOCO's magnets are produced by a sintering process. (Bohlmann, Tr. at 1748-49). The administrative law judge also finds that NEOCO's magnet is a "permanent magnet," as required by claim 2 of the '723 patent, because its coercivity value of 13.2 kiloOersteds (or 13,000 Oersteds) exceeds the minimum level of 1,000 Oersteds, which is the definition for a permanent magnet in the art. (Guruswamy, Tr. at 476; CX-49, Tab 17, CX-51).

The administrative law judge further finds that the energy product of NEOCO's magnet, tested by complainants, is 31.2 megaGaussOersteds ("MGOe"), which exceeds the

[52] As stated supra, complainants have withdrawn claim 32.

minimum level of 10 MGOe set forth in claim 2 of the '723 patent. (Guruswamy, Tr. at 476-77; CX-49, Tab 17; CX-53; CX-71, Tab 24). NEOCO's magnet also satisfies the chemical composition requirements of claim 2 of the '723 patent, in that it contains: (i) a total of 14.60 atomic percent of the rare-earths neodymium, praseodymium, gadolinium, dysprosium, lanthanum, and cerium, which falls within the range from 12-20 atomic percent recited for "R" in the claim; (ii) 13.95 atomic percent of neodymium and praseodymium, which is more than 50 atomic percent of the total amount of "R", as required by the claim; (iii) 6.49 atomic percent boron ("B"), which is within the claimed range from 4-24 atomic percent; and (iv) 74.47 atomic percent iron ("Fe"), which is greater than the minimum amount of 56 atomic percent stated in the claim. (Guruswamy, Tr. at 478-79; CX-49, Tab 17; CX-71, Tab 24).

Moreover, NEOCO's expert, Bohlmann, testified that NEOCO's Sample B magnets, tested by the Ames Laboratory, are within the scope of at least claim 2 of the '723 patent. (Bohlmann, Tr. at 1716). In particular, Bohlmann testified that the Ames Laboratory tests showed that NEOCO's Sample B magnets: (i) are sintered anisotropic permanent magnets; (ii) have a maximum energy product of 25 MGOe, which exceeds the claim minimum of 10 MGOe; and (iii) possess the requisite chemical composition of neodymium and/or praseodymium, iron, and boron. (Bohlmann, Tr. at 1715-16).

Based on the foregoing, the administrative law judge finds that the complainants have met their burden in establishing that NEOCO infringes claim 2 of the '723 patent.

NEOCO argued that it does not infringe each of claims 2, 3, 4, 5, 6, ,7, 8, 9, 13, 14, 15, 16, 17, 18, 19, 20, 24, 25, 26 and 31; that cobalt is required by the '723 patent; that cobalt is an expensive element which NEOCO does not include in its magnets; and that any such element found in NEOCO's magnets would be a trace, or "tramp impurity." (NPost at 112). However, none of the asserted claims of the '723 SSMC patent requires the presence of cobalt in the magnet composition. (See '723 patent claims supra). Thus, the presence or absence of cobalt in NEOCO's magnets is irrelevant to the question of infringement of the asserted claims of the '723 patent.

Based on the foregoing, the administrative law judge rejects NEOCO's argument that it does not infringe any claim of the '723 patent because it does not add cobalt.

Regarding the magnets of the other "Group I" respondents identified by complainants, viz. Multi-Trend, High End (samples E-G and I), and A.R.E., including Jing Ma and Xin Huan, the administrative law judge finds that each of said magnets has the following characteristics: (i) it is a sintered anisotropic permanent magnet; (ii) it has an energy product in excess of 10 MGOe; (iii) it contains 12 to 20 atomic percent rare-earth elements ("R"), of which over 50 atomic percent is neodymium and/or praseodymium; (iv) it contains boron within the range of 4 to 24 atomic percent; and (v) it contains more than 56 atomic percent iron; and (vi) it has an intrinsic coercivity in excess of 1,000 Oersteds. (Guruswamy, Tr. at 483; CX-49, Tabs 1-4, 6, 11-13, 15-17 (Group I Tabs); CX-51; CX-71, Tab 24).

Based on the foregoing, the administrative law judge finds that complainants have sustained there burden in establishing that each of Multi-Trend, High End, A.R.E., Jing Ma and Xin Huan infringe claim 2 of the '723 patent.

b. claims 3-7, 9, 24 and 31

Regarding claims 3-7, 9, 24 and 31 of the '723 patent, the administrative law judge finds that each of the "Group I" respondents' magnets, including NEOCO's, Jing Ma's and Xin

Huan's, satisfies the following compositional limitations: (i) its rare-earth (R) content falls within the range from 12 to 20 atomic percent; (ii) at least 50 atomic percent of R consists of neodymium and/or praseodymium; (iii) it contains 4 to 24 atomic percent boron; and (iv) its iron content exceeds 56 atomic percent. (Guruswamy, Tr. at 493-94; CX-49, Tabs 1-4, 6, 11-13, 15-17; CX-71, Tabs 25-30).

The administrative law judge further finds that each of the "Group I" respondents' magnets, including NEOCO's, Jing Ma's and Xin Huan's, also satisfies the following claimed structural characteristics: (i) it is a sintered anisotropic permanent magnet, as required by all the asserted magnet Claims of the '723 patent; (ii) its mean crystal grain size is about 4 microns, which is within the ranges stated in claims 5 and 6, and exceeds the minimum size of 1 micron set forth in claim 3; (iii) it contains at least one volume percent nonmagnetic phase, as required by claim 4; (iv) at least 50 volume percent of the entire magnet is a ferromagnetic compound having an Fe-B-R type tetragonal crystal structure, as required by claim 3; and (v) its lattice constants a_0 and c_0 are about 8.8 angstroms and 12 angstroms, respectively, as required by claim 24. (Guruswamy, Tr. at 493-96; CX-49, Tabs 1-4, 6, 11-13, 15-17; CX-71, Tabs 25-30).

Moreover, the administrative law judge finds that the "Group I" respondents' magnets, including NEOCO's, Jing Ma's and Xin Huan's, exhibit the magnetic properties set forth in claims 3-7, 9, 24 and 31 of the '723 patent. Specifically, each of said magnets has: (i) an intrinsic coercivity in excess of 1,000 Oersteds, and thus is a "permanent magnet;" and (ii) an energy product in excess of 20 megaGaussOersteds, which satisfies the limitations set forth in claim 9. (Guruswamy, Tr. at 495; CX-51; CX-53; CX-71, Tabs 25-30).

Based on the foregoing, the administrative law judge finds that the complainants have met their burden in establishing that each of NEOCO, Multi-Trend, High End, A.R.E., Jing Ma and Xin Huan infringe claims 3-7, 9, 24 and 31 of the '723 patent.

c. claims 13-20, 25 and 26

With respect to claims 13-20, 25 and 26 of the '723 patent, the staff argued that said claims are not infringed because the total M element are not known. (SPost at 29). The administrative law judge finds, as both the complainants and staff agree (CPostR at 24, SPostR at 7-8), under the proper claim construction of said claims, the total value of "M" is the maximum value for any of the individual M elements present in the magnet. Thus, in order to determine if a magnet falls within said claims, one must know how many of the specified M elements are in the magnet, the total value of <u>all</u> M elements in the magnet, and then one must compare said total value to the maximum value for any of the M elements added.

The administrative law judge finds that the tests conducted by complainants on all of the respondents' magnets did not test for <u>all</u> of the M elements specified in said claims. (CX-49). Moreover, complainants admit that their tests dit not test for <u>all</u> of the M elements specified in said claims. (CPostR at 27). Complainants rely on their expert Guruswamy's testimony to establish infringement of claims 13-20, 25 and 26 of the '723 patent. (CPostR at 28). In that testimony, Guruswamy testified that the respondents' magnets satisfy the requirements of claims 13-20, 25 and 26 of the '723 patent because:

> [t]hey contain M elements within the specified ranges, for individual elements and as a group; there is a minimum – and at least percent of R consists of either neodymium or praseodymium or a combination of the two.

(Guruswamy, Tr. at 494). However, the administrative law judge finds that said testimony in no way indicates that respondents' magnets could not contain any of the other M elements for which complainants did not test. Without knowing what other M elements may be in a magnet he finds that it is impossible to determine the total value of M elements, and to determine if the total value of M elements exceeds the maximum value specified in the claims in issue for any M added.

While complainants argued that "[i]t is unnecessary to test for every element, therefore, if the test results confirm that the total of the 'M' elements would fall within the 'maximum' limit of one of the elements present in the magnet" (CPostR at 27), a test that does not test for all M elements cannot by definition confirm that the total of M elements would fall within the maximum limit of one of the M elements present. The administrative law judge also rejects complainants' argument that "it was enough for complainants to show by expert testimony that the 'M' elements would not have exceeded the claim limit" (CPostR at 29), because complainants never showed, by any testimony that the M elements of respondents' magnets would not have exceeded the claim limit for the total of all of the M elements specified in the claims in issue. Guruswamy's testimony, set forth supra, does not demonstrate that respondents' magnets do not have any of the other M elements specified by claims 13-20, 25 and 26 of the '723 patent.

Based on the foregoing, the administrative law judge finds that the complainants have not met their burden in establishing that any of the respondents has infringed claims 13-20, 25 and 26 of the '723 patent.[53]

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[53] Like the claim interpretation issue involving the claimed term "crystalline R(Fe,CO)BXAM compound," the staff appears not to have raised the "M" element issue until it filed its initial posthearing submission on July 13, 1999. The administrative law judge, however, does not treat the "M" element issue in the same way as the "crystalline R(Fe,CO)BXAM compound" issue, because the "M" element issue does not concern any disputed claim

d. claim 8

With respect to claims 8 and 19 of the '723 patent, the administrative law judge finds that each of the magnets from Jing Ma and Xin Huan satisfies all the elements of claims 2 and 3 (see supra), from which claim 8 depends. (CX-4, col. 25, lines 42-44; CX-71, Tabs 24, 25, 27, 28). In addition, each of the Jing Ma and Xin Huan magnets satisfies the following elements, recited in claim 8: (i) a boron concentration of about 8.0 atomic percent; and (ii) a total rare-earth ("R") concentration of about 15 atomic percent. (Guruswamy, Tr. at 499-501; CX-49, Tabs 2-4; CX-71, Tabs 26, 29).

Based on the foregoing, the administrative law judge finds complainants have met their burden in establishing that each of Jing Ma and Xin Huan infringe claim 8 of the '723 patent.

e. claim 34

With respect to claim 34 of the '723 patent (FF 130), the administrative law judge finds that, as discussed with respect to claims 2 and 3 supra, the Multi-Trend and Jing Ma magnets satisfy all the elements of claims 2 and 3 from which claim 34 may depend. (CX-4, col. 28, lines 47-48; CX-71, Tabs 24, 25, 27, 28). In addition, each of the Multi-Trend and Jing Ma magnets has a cobalt content of zero atomic percent, which satisfies the requirement of claim 34 that the magnet be substantially free of cobalt. (Guruswamy, Tr. at 502; CX-49, Tabs 3-6; CX-71, Tab 30).

Based on the foregoing, the administrative law judge finds that each of Multi-Trend and Jing Ma infringe claim 34 of the '723 patent.

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construction. Moreover, it is a fact that complainants admitted that they did not test for any of the "M" elements.

f. claims 27 and 33

Complainants argued that the test results performed on accused magnets and the testimony of Bohlmann show that claims 27 and 33 an infringed. (CPost at 39-42).

The staff argued that complainants have shown that claims 27 and 33 have been infringed by some of the sample magnets. (SPostR at 17). Specifically, the staff argued that those claims do not claim "magnetic materials" per se, but instead claim magnetic articles in the form of sintered mass of such magnetic material; and that "since the accused magnets fall within the other limitations of these claims," they infringe claims 27 and 33 of the '723 patent.

The Federal Circuit in Wahpeton Canvas Company, Inc. v. Frontier, Inc., 870 F.2d 1546, 1552 n. 9, 10 U.S.P.Q.2d 1201, 1207 n. 9 (Fed. Cir. 1989) has held that infringement of a claim cannot be found absent a finding of infringement upon which the claim depends, stating:

> One may infringe an independent claim and not infringe a claim dependent on that claim. The reverse is not true. One who does not infringe an independent claim cannot infringe a claim dependent on (and thus containing all the limitations of) that claim.

Id. (Emphasis added). See also 3 Chisum, Patents, §8.06[5] (1997). Thus complainants must show infringement of not only claims 27 and 33 but infringement of the claims upon which claims 27 and 33 depend.

Claim 27 is dependent on claim 1 or claim 12 (FF 128) and therefore incorporates those claims by reference. Also claim 3 is dependent upon claim 32 and therefore incorporates claim 32. Claim 32 in turn is dependent on claims 1, 12, 24 or 30 and therefore incorporates those claims.

Complainants, in connection with meeting its burden of establishing infringement of the prior claims of the '723 patent, relied on the analysis of complainants' tests of the accused magnets by complainants' expert. See supra. However, with respect to claims 27 and 33 and claims 1, 12, 20 and 32[54] of the 723 patent, complainants did not cite to an analysis by complainants' expert of the results of the tests conducted by complainants on the accused magnets. Complainants simply relied directly on the raw test data without their expert applying said data to claims 27 and 33. (CPost at 39-42). The administrative law judge has examined the raw test data, and finds absent expert testimony at least said data is ambiguous. Merely to illustrate, there is included in the data (CX-49, Tab 17) an energy product graph. The administrative law judge is unable to determine from the graph what NEOCO's magnets' energy product is. Also there is a graph termed "Theta Scale" which relevance cannot be determined.

Complainants rely on the testimony of NEOCO's expert Bohlmann to support their assertion of infringement of claims 27 and 33 of the '723 patent. (CPost at 40, citing Bohlmann Tr. at 1746). However, the testimony of Bolhmann upon which complainants rely is directed towards the conventional process for making sintered Nd-FeB magnets. (Bohlmann Tr. at 1748-1749). Thus, Bolhmann stated:

> Q. The process you just discussed with Mr. Parker, is it your understanding that that's the process used to create NEOCO's magnets?
>
> A. Yes. I do not know firsthand their process, but I believe that it would be a sintering process, a conventional sintering process.

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[54] Claims 1, 12, 30 and 32 have been withdrawn from the investigation. See Order No. 59.

(Bohlmann Tr. at 1748-1749). Bolhmann merely described the conventional sintering process. He did not apply the results of complainants' test to claims 27 and 33 nor any of the claims upon which those claims depend. Thus, Bohlmann did not testify whatsoever concerning infringement of claims 27 and 33 of the '723 patent. The administrative law judge cannot find any expert testimony, from complainants' expert or NEOCO's expert, regarding the infringement of claims 27 and 33 of the '723 patent.

Based on the foregoing, the administrative law judge finds that complainants have not met their burden in establishing infringement by any respondents of claims 27 and 33 of the '723 patent.

2. The '368 Patent

Complainants have used the term " 'Group II' Respondents" to refer to the magnets of former respondents AUG, CYNNY, Houghes (samples A and B), and to refer to respondents Harvard (samples A. B. C), High End (samples D, E, F, G, H and I), A.R.E. and NEOCO with respect to alleged infringement of the '368 patent (CPost at 45). Complainants argued that each of the Group II respondents' magnets infringes claims 2 and 3 of the '368 patent (CPost at 45-46); that each of the Group II respondents' magnets infringes claims 4-6, 8, 10 and 37 of the '368 patent (CPost at 46-47); that each of the Group II respondents' magnets infringes claims claims 15 and 16 of the '368 patent (CPost at 47-48); that each of the Group II respondents' magnets satisfy all the elements of claims 17-19, 21, 24 and 29-31 of the '368 patent (CPost at 48); that the CYNNY and Houghes (samples A and B) magnets infringe claims 9 and 23 of the '368 patent (CPost at 49); that that each of the magnets of the Houghes (sample B), Harvard (samples A, B and C) and High End (sample D) satisfies all of the elements of claim 38 of the '368 patent (CPost at 49-50); that each of the Group II respondents' magnets has the features specified in claims 28 and 35 of the '368 patent. (CPost at 50-52).

The staff argued that the magnets of each of the Group II respondents infringe claims 2, 3 and 10 of the '368 patent (SPost at 36-44); that complainants have failed to meed their burden that any of the respondents' magnets infringe each of claims 15, 16, 17,18, 19, 21, 23, 24, 30 and 31 of the '368 patent (SPost at 38-41, 42-43, 44); that the magnets of the Group II respondents infringe claims 5, 6 and 8 of the '368 patent (SPost at 41, 42); that the magnets of CYNNY and Houghes fall within the limits of claim 9 (SPost at 42-43); that the magnets of CYNNY, Houghes, Harvard, High End, and A.R.E. infringe claim 37 (SPost at 43); that the Houghes B sample, the Harvard A, B and C samples and the High End D sample fall within the limits of claim 38 (SPost at 44); that the sample magnets of the Group II Respondents all fall with claim 10 and 29. (SPost at 44, 45).

In issue are independent claims 2, 3, 15 and 16 and dependent claims 4, 5, 6, 8, 9, 10, 17, 18, 19, 21, 23, 24, 28, 29, 30, 31, 35, 37 and 38. (FF 76). Claim 2 is directed to a sintered anisotropic permanent magnet that: (i) has a maximum energy product greater than 10 megaGaussOersteds (MGOe); (ii) contains 12-20 atomic percent of the element R, where R is drawn from the group of rare-earths listed in the claim; (iii) requires that at least 50 atomic percent of the element R be comprised neodymium and/or praseodymium; (iv) contains 5-18 atomic percent boron (B); (v) the balance of the magnet being at least 62 atomic percent iron (Fe); (vi) a portion of the iron is substituted by cobalt (Co) by an amount greater than 0 and not exceeding 25 atomic percent of magnet; and (vii) the magnet has a higher Curie temperature than a similar magnet containing no cobalt. (FF 77).

Claim 3, while directed to a sintered anisotropic permanent magnet similar to that described in claim 2, adds that: (i) the magnet's mean crystal grain size is at least one micron; (ii) the magnet contains at least 50 volume percent of a ferromagnetic Fe-B-R type compound; and (iii) the (Fe, Co)-B-R type compound has a tetragonal crystal structure. (FF 78). Claim 4 describes a permanent magnet as defined in claim 3, which contains no less than 1 vol. % of nonmagnetic phases. (FF 79). Claim 5 requires a permanent magnet as defined in claim 2 or 3 in which the mean crystal grain size is 1 to 100 microns. (FF 80).

Claim 6 requires a permanent magnet as defined in claim 5, in which the mean crystal grain size is in the range from 1.5 to 50 microns. (FF 81). Claim 8 describes a permanent magnet as defined in claim 2 or 3, in which Sm does not exceed 3 atomic percent in the entire magnet. (FF 82). Claim 9 describes a permanent magnet as defined in claim 2 or 3, in which R is about 15 atomic percent, and B is about 8 percent. (FF 83). Claim 10 describes a permanent magnet as defined in claim 2 or 3, in which the maximum energy product is at least 20 MGOe. (FF 84).

Claim 15 has the same maximum energy, Curie temperature and chemical composition, including Fe balance and Co substitution requirements as claim 2, but which adds, with respect to the chemical composition, at least one additional element M selected from the group specified in the claim in the amounts no more than specified in the claim, wherein the sum of M is no more than the maximum value of any one of the values specified in the claim for M actually added. (FF 85).

Claim 16 has the same requirements as claim 3, and adds, with respect to chemical composition, the same M element requirements as claim 15. (FF 86). Claim 17 requires a permanent magnet as defined in claim 16, which contains no less than 1 vol. % of nonmagnetic phases. (FF 87). Claim 18 describes a permanent magnet as defined in claim 15 0r 16, in which the mean crystal grain size is in the range from 1 to 100 microns. (FF 88). Claim 19 requires a permanent magnet as defined in claim 18, in which the mean crystal grain size is in the range from 1.5 to 50 microns. (FF 89).

Claim 21 requires a permanent magnet as defined in claim 13 or 14, in which Sm is no more than 3 atomic percent in the entire magnet. (FF 90). Claim 23 requires a permanent magnet as defined in claim 15 or 16, in which R is about 15 atomic percent, and B is about 8 atomic percent. (FF 91). Claim 24 describes a permanent magnet as defined in claim 15 or 16, in which the maximum energy product is at least 20 MGOe. (FF 92).

Claim 28 describes a magnetic article in the form of powder compact or sintered mass of the magnetic material as defined in any of claims 1 and 13. (FF 98). Claim 29 describes a sintered anisotropic permanent magnet as defined in claim 3 or 16 wherein said (Fe, Co)-B-R type tetragonal crystal structure has the lattice constants a_0 of about 8.8 angstroms and c_0 of about 12 angstroms. (FF 93). Claim 30 requires a permanent magnet as defined in claim 15 or 16 wherein said additional element(s) M is at least one selected from the group consisting of V, Nb, Mo, W and Al. (FF 94).

Claim 31 describes a magnet as defined in claim 31 [sic], wherein said additional element(s) M is contained no more than the amount by atomic percent as specified in the claim, and wherein the sum of M does not exceed the maximum value of any one of the values specified in the claim for M actually added. (FF 95). Claim 35 requires a magnetic article in the form of "powder compat [sic]" or sintered mass of the magnetic material as defined in claim 34. (FF 98).

Claim 37 requires a sintered anisotropic permanent magnet as defined in claim 2, 3, 15 or 16 in which R is Nd. (FF 98). Claim 38 describes a sintered anisotropic permanent magnet as defined in claim 2, 3, 15 or 16, in which Co is present in at least 1 atomic percent. (FF 98).

a. claims 2 and 3

With respect to claims 2 and 3 of the '368 patent, the administrative law judge finds that the NEOCO sample magnet tested by complainants is a sintered anisotropic permanent magnet, as required by both claims 2 and 3 of the '368 patent. (Guruswamy, Tr. at 527-28, 266-67; CX-49, Tab 17; CX-48, Tab 74; CX-51, CX-71, Tabs 31, 32; Bohlmann, Tr. at 1748-49). Said magnet has a maximum energy product of 31.2 MGOe, which exceeds the minimum value of 10 MGOe recited in claims 2 and 3 of the `368 patent. (CX-53; CX-49, Tab 17; CX-71, Tabs 31, 32). NEOCO's magnet also has the chemical composition required by both claims 2 and 3 of the `368 patent: (i) it contains the rare-earth elements (R) neodymium, praseodymium, gadolinium, dysprosium, lanthanum, and cerium, as set forth in the claims; (ii) it has a total rare-earth content of about 14.6 atomic percent, which falls with the claimed range from 12-20 atomic percent; (iii) over 50 atomic percent of the rare-earth content is neodymium and/or praseodymium; (iv) it contains about 6.49 atomic percent boron, which is within the claimed range from 5-18 atomic percent; (v) it contains about 74.47 atomic percent iron, which is greater than the minimum value of 62 atomic percent iron recited in the claim; and (vi) it contains about 0.10 atomic percent cobalt, which is within the claimed range from greater than 0 and not exceeding 25 atomic percent. (Guruswamy, Tr. at 529-31; CX-49, Tab 17; CX-71, Tabs 31, 32).

The administrative law judge further finds that the presence of cobalt in NEOCO's magnet increases its Curie temperature compared to a similar Fe-B-R magnet compound containing no cobalt, as required by claims 2 and 3 of the '368 patent. (Guruswamy, Tr. at 531-32, 780-81; CX-49, Tab 17; CX-71, Tabs 31, 32). NEOCO's magnet also has a mean crystal grain size between 4-40 microns, which is more than the minimum value of 1 micron required by claim 3 of the `368 patent. (Guruswamy, Tr. at 266; CX-48, Tab 74; CX-71, Tab 32). At least 50 volume percent of NEOCO's magnet is occupied by a ferromagnetic compound having an (Fe, Co)-B-R type tetragonal crystal structure, as required by claim 3 of the '368 patent. (CX-71, Tab 32).

Moreover, NEOCO's expert, Bohlmann, testified that the NEOCO Sample B magnet, tested by Ames laboratory, possessed the following elements set forth in claim 2 of the '368 patent: (i) they are sintered anisotropic permanent magnets; (ii) they have a maximum energy product in excess of 10 MGOe; (iii) they have the requisite amounts of neodymium and/or praseodymium, iron, and boron; and (iv) they include more than 0 and not exceeding 25 atomic percent of cobalt. (Bohlmann, Tr. at 1716-24).

Based on the foregoing, the administrative law judge finds that complainants have met their burden in establishing that NEOCO infringes claims 2 and 3 of the '368 patent.

NEOCO argued that it does not infringe claims 2, 3, 4, 5, 6, 8, 9, 10, 15, 16, 17, 18, 19, 21, 23, 24, 30, 31 and 37 as the asserted claims require cobalt; that cobalt is an expensive element which NEOCO does not include in its magnets; and that any such element as cobalt found in NEOCO's magnets would be a trace, or "tramp impurity." (NPost at 111). However, despite NEOCO's argument that its magnets don't include cobalt, the fact is that tests done on its magnets show that NEOCO's magnets do, indeed, include cobalt in the specified amounts as required in the asserted claims of the '368 patent. Moreover, NEOCO cannot avoid infringement because it does not "intentionally" add cobalt, and that the cobalt present is a "tramp impurity." NEOCO has not cited any expert testimony to show that because cobalt occurs as a "tramp impurity" it is not infringing, even though the amount of cobalt is within the claimed amounts. Also, it is well established that infringement does not require proof of the intent of the accused infringer to infringe. Warner-Jenkinson Co., Inc. v. Hilton Davis Chem. Co., 117 S.Ct 1040, 1052, 41 U.S.P.Q.2d 1865, 1873 (1997). Once the claim is construed, the only remaining inquiry is whether the accused magnet contains every limitation recited in that claim. General Mills, Inc. v. Hunt-Wesson, Inc., 103 F.3d 978, 981, 41 U.S.P.Q.2d 1440, 1442 (Fed. Cir. 1997). Thus, NEOCO's argument that it did not intentionally add cobalt to its magnets is to no avail.

Based on the foregoing, the administrative law judge rejects NEOCO's arguments that it does not infringe the '368 patent because NEOCO does not include cobalt in its magnets and that any such element as cobalt found in NEOCO's magnets would be a trace, or "tramp impurity."

With respect to the magnets of the other "Group II" respondents, viz., Harvard (samples A. B. C), High End (samples D, E, F, G, H and I), A.R.E. and Xin Huan, the administrative law judge finds that each of said magnets: (i) has an intrinsic coercivity value in excess of 1,000 Oersteds, and thus is a "permanent magnet," which is understood in the art as a magnet having a minimum coercivity of 1,000 Oersteds; (ii) is an anisotropic and sintered magnet; (iii) has a maximum energy product in excess of 10 MGOe; (iv) contains rare-earth elements (R) in an amount between 12-20 atomic percent, of which more than 50 percent consists of neodymium and/or praseodymium; (v) contains between 5-18 atomic percent boron; (vi) contains in excess of 62 atomic percent iron; (vii) contains cobalt in an amount greater than 0 and not exceeding 25 atomic percent of the magnet; (viii) has a higher Curie temperature than a comparable Fe-B-R magnet containing no cobalt; (ix) has a mean crystal grain size in excess of 1 micron; and (x) is composed of at least 50 volume percent of a ferromagnetic compound having an (Fe, Co)-B-R type tetragonal crystal structure. (Guruswamy, Tr. at 539-40, 550 -51; CX-49, Tabs 1, 2, 4, 5, 7-17; CX-51, CX-53; CX-71, Tabs 31, 32).

Based on the foregoing, the administrative law judge finds that complainants have met their burden in establishing that each of Harvard, High End, A.R.E., and Xin Huan infringe claims 2 and 3 of the '368 patent.

b. claims 4-6, 8, 10 and 37

Regarding claims 4-6, 8, 10 and 37 of the '368 patent, the administrative law judge finds that each of the "Group II" respondents' magnets, including NEOCO's, satisfies all the elements of claims 2 and 3 of the '368 patent, discussed supra, upon which claims 4-6, 8, 10 and 37 depend. (CX-5, col. 25, lines 1-6, 9-11, 15-17, col. 28, lines 30-31; CX-71, Tabs 31, 32, 33).

In addition, the administrative law judge finds that each of the "Group II" respondents' magnets, including NEOCO's, satisfies the additional claim elements recited in claims 4-6, 8, 10, and 37 of the '368 patent, namely, it has: (i) at least 1 volume percent of a non-magnetic phase; (ii) a mean crystal grain size between 1.5 and 50 microns; (iii) no more than 3 atomic percent samarium; (iv) an energy product of at least 20 MGOe; and (v) between 12-20 atomic rare-earth elements, including neodymium and/or praseodymium. (Guruswamy, Tr. at 550-53; CX-49, Tabs 1, 2, 4, 5, 7-17; CX-53; CX-71, Tab 33, 36).

Based on the foregoing, the administrative law judge finds that complainants have met their burden in establishing that each of Harvard, High End, A.R.E., NEOCO and Xin Huan infringe claims 4-6, 8, 10 and 37 of the '368 patent.

c. claims 15, 16, 17-19, 21, 23, 24, 30 and 31

Regarding claims 15, 16, 17-19, 21, 23, 24, 30 and 31 of the '368 patent, each of said claims involves the addition of an M element, as was similarly required in certain of the '723 patent claims. See supra. As stated above in connection with the '723 patent, supra, the complainants did not test any of respondents' magnets for all of the M elements specified in the claims in issue. Absent any evidence in the record that the respondents' magnets could not contain any M elements that were not tested for by the complainants, the administrative law judge finds that it is impossible to determine the total value of M elements in any given magnet, and thus to determine if the total value of M elements exceeds the maximum value specified in the claims in issue for any M element added.

Based on the foregoing, the administrative law judge finds that the complainants have not met their burden in establishing that any of the respondents infringe claims 15, 16, 17-19, 21, 23, 24, 30 and 31 of the '368 patent.[55]

d. claim 29

With respect to claim 29 which is dependent, either directly or indirectly, upon claims 3 or 16, the administrative law judge finds that the magnets of the "Group II" respondents, including

[55] Like the claim interpretation issue involving the claimed term "crystalline R(Fe,Co) BXAM compound", the staff appears not to have raised the "M" element issue involving the '368 patent until the filing of its initial posthearing submission on July 13, 1999. The administrative law judge does not treat the "M" element issue as he does the claim interpretation issue. See fn. 53 supra.

NEOCO, satisfies the limitations recited in claim 29 of the '368 patent, namely: the lattice constants "a_0" and "b_0" for its tetragonal (Fe, Co)-B-R type crystalline structure are about 8.8 angstroms and 12 angstroms, respectively. (Guruswamy, Tr. at 550-55; CX-49, Tabs 1, 2, 4, 5, 7-17; CX-71, Tab 36).

Based on the foregoing, the administrative law judge finds that complainants have met their burden in establishing that each of Harvard, High End, A.R.E., NEOCO and Xin Huan infringes claim 29 of the '368 patent.

e. claim 9

Regarding claim 9 of the '368 patent, the administrative law judge finds that the magnet of Xin Huan satisfies all the elements of claims 2 and 3 as discussed supra, upon which claim 9 depends. (CX-71, Tabs 31, 32, 34, 35, 36). In addition, said magnet has a boron content of about 8 atomic percent and a rare-earth content of about 15 atomic percent, as required by claim 9 of the '368 patent. (Guruswamy, Tr. at 556-57, 561-62; CX-49, Tabs 2, 4, 5; CX-71, Tabs 33, 36).

Based on the foregoing, the administrative law judge finds that complainants have established their burden in establishing that Xin Huan infringes claim 9 of the '368 patent.

f. claim 38

With respect to claim 38 of the '368 patent, the administrative law judge finds that the Xin Huan, Harvard (samples A, B, and C), and High End (sample D) magnets are among the "Group II" respondents' magnets that satisfy all the elements of claims 2 and 3 as discussed supra, upon which claim 38 depends. (Guruswamy, Tr. at 266, 527-32, 539-40, 554-55; CX-49, Tabs 1, 2, 4, 5, 7-17; CX-51, CX-53; CX-71, Tabs 31, 32, 34, 35, 37). In addition, each of the Xin Huan, Harvard (samples A, B, and C), and High End (sample D) magnets has a cobalt content in excess of one atomic percent, as required by claim 38 of the '368 patent. (Guruswamy, Tr. at 563; CX- 49, Tabs 5, 7-10).

Based on the foregoing, the administrative law judge finds that complainants have met their burden in establishing that each of Xin Huan, Harvard and High End infringe claim 38 of the '368 patent.

g. claims 28 and 35

Both claims 28 and 35 of the '368 patent are in a similar situation as claims 27 and 33 of the '723 patent. Claim 28 depends upon claims 1 or 13, and therefore incorporates said claims by reference. Claim 35 depends upon claim 34, which depends upon claims 1, 13, 32 or 33. Therefore claim 35 incorporates claims 34, 1, 13, 32 and 33 by reference.

While each of complainants and the staff argued that claims 28 and 35 are infringed, the complainants proffered no testimony from its expert concerning infringement of claims 28 and 35 of the '368 patent or any of the claims upon which said claims depend,[56] but merely relied on the raw test data and testimony of NEOCO's expert Bohlmann. (CPost at 50-52).

As discussed supra, said test data is ambiguous absent expert testimony and Bohlmann's testimony is not relevant.

Based on the foregoing, the administrative law judge finds that complainants have not met their burden in establishing that any respondents infringe claims 28 and 35 of the '368 patent.

3. The '651 Patent

Complainants have argued that NEOCO's Sample B magnet and all the magnets

[56] Claims 1, 13, 32, 33 and 34 have been withdrawn. See Order No. 59.

submitted by respondents AUG, CYNNY, H.T.I.E., Houghes (samples A and B). Multi-Trend, Harvard (samples A, B, and C), High End (samples D, E, F, G, H and I) and A.R.E. satisfy all the claim elements of claim 1 of the '651 patent (CPost at 54-55); that each of the Group II Respondents' magnets infringes claims 2 and 3 of the '651 patent (CPost at 55) that the H.T.I.E. and Multi-Trend magnets infringe claim 5 of the '651 patent (CPost at 55-56); and that "all" of respondents' magnets including NEOCO's , infringe claims 15, 18, 19, 21 and 22 of the '651 patent. (CPost at 56-57).

The staff argued that the '651 patent claims a particular phase containing certain elements; that the accused magnets all contain at least two phases and therefore complainants have the burden of showing that a single phase wihtin the accused magnets contain the claimed elements; that complainants merely showed that the entire magnet contained the claimed elements and it is not known if any phase within the accused magnets contain all of the claimed elements; and that therefore infringement is not shown. (SPost at 45-50).

NEOCO argued that it does not infringe claims 1, 2, 3, 5, 15, 18, 19, 21 and 22;[57] that the '651 patent requires a ternary alloy with cobalt; that cobalt is an expensive element which NEOCO does not include in its magnets; and that any such element as cobalt found in NEOCO's magnets would be a trace, or tramp impurity. (NPost at 111, 112). NEOCO also joined in the staff's argument that the accused magnets all contain at least two phases and that complainants merely showed that the entire magnet contained the claimed elements and it is not known if any phase within the accused magnets contain all of the claimed elements. (Tr. at 2127).

[57] NEOCO in its argument (NPost at 111) erroneously refers to claims "2, 3, 4, 9, 13, 14, 15, 16, 17, 18, 19, 20, 24, 26 and 31."

In issue are independent claim 1 and dependent claims 2, 3, 5, 15, 18, 19, 21 and 22 of the '651 patent. (FF 138). The '651 patent claims a "crystalline compound" containing rare earths, boron, iron and/or cobalt, plus other elements. Claim 1 of the '651 patent is the only independent claim, and reads as follows:

> "A crystalline R(Fe,Co)BXAM compound having a stable tetragonal crystal structure having lattice constants of a_0 about 8.8 angstroms and c_0 about 12 angstroms, in which R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and Y, X is at least one element selection from the group consisting of S, C, P, and Cu, A is at least one element selected from the group consisting of H, Li, Na, K, Be, Sr, Ba, Ag, Zn, N, F, Se, Te and Pb, and M is at least one element selected from the group consisting of Ti, Ni, Bi, V, Nb, Ta, Cr, Mo, W, Mn, Al, Sb, Ge, Sn, Żr, Hf and Si.

FF 139.

In the "Claim Interpretation" (Section III C supra), the administrative law judge has found that one of ordinary skill in the art would not limit the claimed term "Re(Fe,Co)BXAM compound" and the recited "R(Fe,Co)BXAM" elements of independent claim 1 to a single phase.

Each of the other asserted dependent claims 2, 3, 5, 15, 18, 19, 21, and 22 claim the crystalline compound of claim 1, with the following additional limitations: Co present up to 50 atomic percent of the sum of Fe and Co (claim 2), (FF 140); Co present up to 100 atomic percent of the sum of Fe and Co (claim 3), (FF 141); Co not present (claim 5), (FF 142); M selected from the group consisting of V, Si and Al (claim 15), (FF 143); having a crystal size of at least 1 μm (claim 18), (FF 144); where at least 50 atomic percent of R is at least one element selected from the group consisting of Nd and Pr (claim 19), (FF 145); where R is at least one element selected from the group consisting of Nd, Pr, Tb, Dy and Ho (claim 21), (FF 146); and where the compound has magnetic anisotropy (claim 22). (FF 147).

With respect to claim 1 of the '651 patent, the administrative law judge finds that the NEOCO sample magnet, tested by complainants, contains a crystalline R(Fe,Co)BXAM compound having a stable tetragonal crystal structure with lattice constants of "a_o" and "b_o" of about 8.8 angstroms and 12.2 angstroms, respectively, as required by claim 1 of the '651 patent. (Guruswamy, Tr. at 577-78; CX-49, Tab 17; CX-71, Tab 38). In addition, the crystalline compound in the NEOCO magnet contains: (i) neodymium (Nd), praseodymium (Pr), and other rare-earth elements that satisfy the claim element R; (ii) iron (Fe), cobalt (Co), and boron (B), as set forth in the claim; (iii) sulfur (S) and carbon (C), which satisfy the element X; (iv) sodium (Na) and nitrogen (N), which satisfy the element A; and (v) manganese (Mn), aluminum (Al), and zirconium (Zr), which satisfy the element M of claim 1 of the '651 patent. (Guruswamy, Tr. at 577-80, 780-81; CX-49, Tab 17; CX-71, Tab 38).

Moreover, NEOCO's expert, Bohlmann, testified that NEOCO's Sample B magnets, tested by the Ames laboratory, satisfy all the elements of claim 1 of the '651 patent, with the possible exception of the presence of the A element, which was not tested by the Ames Laboratory. (Bohlmann, Tr. at 1724-26). The staff does not dispute that the testimony and test results show that the required elements of the asserted claim exist in the accused magnets.

Based on the foregoing, the administrative law judge finds that complainants have met their burden in establishing that NEOCO infringes claim 1 of the '651 patent.

With respect to the magnets of the other respondents, viz., Multi-Trend, Harvard (samples A, B, and C), High End (samples D, E, F, G, H, and I), A.R.E., Jing Ma and Xin

Huan, the administrative law judge finds that each of said magnets contains a compound having a stable tetragonal crystal structure with lattice parameters of a_0 of about 8.8 and c_0 of about 12 angstroms. The compound contains (i) neodymium, praseodymium, and other "R"elements; (ii) iron or iron mixed with cobalt; (iii) boron; and (iv) elements belonging to the groups "X", "A", and "M" set forth in claim 1 of the '651 patent. (Guruswamy, Tr. at 581-83; CX-49, Tabs 1-16; CX-71, Tab 38).

Based on the foregoing, the administrative law judge finds that each of Multi-Trend, Harvard, High End, Jing Ma, Xin Huan and A.R.E. infringe claim 1 of the '651 patent.

Regarding claims 2 and 3 of the '651 patent, the administrative law judge finds that the magnets from the "Group II" respondents, viz., Harvard (samples A, B, and C), High End (samples D, E, F, G, H, and I), A.R.E., Xin Huan and NEOCO, satisfy all the elements of claim 1 of the '651 patent as discussed supra, upon which claims 2 and 3 depend. (Guruswamy, Tr. at 577-83; CX-71, Tab 38). In addition, each of the "Group II" respondents' magnets contains cobalt in amounts greater than zero but less than 50 atomic percent of the sum of iron and cobalt, or in amounts greater than 0 but less than 100 atomic percent of the sum of iron and cobalt, as set forth in claims 2 and 3 of the `651 patent respectively. (Guruswamy, Tr. at 625, 632; CX-49, Tabs 1, 2, 4, 5, 7-17; CX-71, Tab 39).

As stated supra, the administrative law judge rejects NEOCO's argument that it does not infringe the '651 patent because any cobalt found in its magnets is just a "tramp impurity," and that NEOCO does not intentionally add cobalt to its magnets. NEOCO has pointed to no expert testimony that shows that because cobalt exists in its magnets as a "tramp impurity" NEOCO does not meet the claim language or otherwise does not infringe the '651 patent. The evidence establishes that NEOCO's magnet contains cobalt in the amount specified in claims 2 and 3 of the '651 patent, and the fact that such an amount is considered by NEOCO to be a "tramp impurity" does not render the magnets non-infringing. Furthermore, as stated supra, whether or not NEOCO intended to put cobalt in its magnets is irrelevant.

Based on the foregoing, the administrative law judge finds that complainants have met their burden in establishing that each of Harvard, High End, A.R.E., Xin Huan and NEOCO infringe claims 2 and 3 of the '651 patent.

With respect to claim 5 of the '651 patent, the administrative law judge finds that the Jing Ma and Multi-Trend magnets satisfy all the elements of claim 1 of the '651 patent as discussed supra, upon which claim 5 depends. (Guruswamy, Tr. at 581-83; CX-49, Tabs 3, 6; CX-71, Tabs 38, 39). In addition, the Jing Ma and Multi-Trend magnets contain no cobalt, as required by claim 5 of the '651 patent. (Guruswamy, Tr. at 631; CX-49, Tabs 3, 6).

Based on the foregoing, the administrative law judge finds that complainants have met their burden in establishing that each of Jing Ma and Multi-Trend infringe claim 5 of the '651 patent.

Regarding claims 15, 18, 19, 21 and 22 of the '651 patent, the administrative law judge finds that all of respondents' magnets, including NEOCO's, satisfy all of the elements of claim 1 of the '651 patent as discussed supra, from which each of claims 15, 18, 19, 21, and 22 depends. (Guruswamy, Tr. at 577-83; CX-71, Tabs 38, 39). In addition, the crystalline compound in each of respondents' magnets, including NEOCO's: (i) contains aluminum, and thus has at least one element from the M group, as defined in claim 15; (ii) has a crystal size in excess of one micron, as required in claim 18; (iii) contains neodymium, and thus has at least one element selected from the group R defined in claim 21; (iv) contains neodymium and praseodymium in such an amount that they exceed 50 atomic percent of the total rare-earths (R) in the magnet, as in claim 19; and (v) is magnetically anisotropic, as stated in claim 22. (Guruswamy, Tr. at 624; CX-49, Tabs 1-17; CX-71, Tab 39).

Based on the foregoing, the administrative law judge finds that complainants have met their burden in establishing that each of NEOCO, Multi-Trend, Harvard, High End, Jing Ma, Xin Huan and A.R.E. infringe claims 15, 18, 19, 21 and 22 of the '651 patent.

VII. Validity (Enablement-Magnequench Patents)

NEOCO argued that the Magnequench patents are invalid for "failing to describe and enable that which is claimed; the essential and critical element of controlled rapid quenching." (Emphasis added) (NPost at 52). Specifically, NEOCO argued that the specifications of the Magnequench patents teach that controlled rapid quenching is the critical element for preparing the claimed alloy; and that, therefore, the asserted claims of the Magnequench patents are invalid for failing to recite the critical quenching. (NPost at 54).

Complainants and the staff both argued that the Magnequench patents are not invalid for lack of enablement or lack of written description. (CPost at 12-14, SPost at 27-30).

35 U.S.C. § 112 provides that the specification of a patent shall contain a written description of the invention. It also provides that said written description must be in sufficiently clear terms as to enable any person skilled in the art to which it pertains to make and use the invention, and shall set forth the best mode contemplated by the inventor of carrying out his invention. The Federal Circuit has held that the written description requirement and the enablement requirement are distinct requirements. Vas-Cath, Inc. v.

Mahurkar, 935 F.2d 1555, 19 U.S.P.Q.2d 1111, 1115 (Fed. Cir. 1991).

In order to satisfy the written description requirement of 35 U.S.C. § 112 the specification must convey to a person of ordinary skill in the art that the inventor was in possession, at the time of filing the application, of the specific subject matter claimed. In re Alton, 76 F.3d 1168, 1127, 37 U.S.P.Q.2d 1578, 1581 (Fed. Cir. 1996). Moreover, "the description must clearly allow persons of ordinary skill in the art to recognize that [he or she] invented what is claimed." In re Gostelli, 872 F.2d 1008, 1012, 10 U.S.P.Q.2d 1614, 1618 (Fed. Cir. 1989) (Emphasis added).

As discussed in Section IV A and VI B section supra, the asserted claims of the Magnequench patents are directed to magnetic alloys and compositions with certain components present in prescribed amounts and containing certain magnetic characteristics. The asserted claims are not directed to a particular process for making the magnets and magnetic alloys or compositions. Furthermore, the administrative law judge finds that the specifications of the Magnequench patents clearly describe the compositions and magnetic characteristics of the claimed magnets. (CX-1, col. 2 lines 11-41; CX-2, col. 2 line 10 to col. 3 line 55; CX-3, col. 5, lines 11-16, 33-35).

The administrative law judge rejects NEOCO's argument that the written description requirement requires that any limitation which is taught in the specification must be included in the claims. (NPost at 53, citing In re Mayhew, 527 F.2d 1229, 1233, 188 U.S.P.Q. 356, 358 (CCPA 1976). Mayhew is found inapposite because that case involved process claims, viz., the method for the production of a corrosion resistant, iron-zinc alloy coating on a steel strip. Id. at 365. As stated supra, the asserted claims of the Magnequench patents are not process claims but product claims. It is well established that an inventor may claim a new and useful compound without limiting the claim to the method for making or using that compound. SRI Int'l v. Matsushita Electric Corp., 775 F.2d 1107, 1112 (Fed. Cir. 1985), see also Chisum On Patents, §5.04(6).

In order to satisfy the enablement requirement of 35 U.S.C. § 112 a patent specification must contain a written description of the invention in sufficiently clear terms as to enable a person of ordinary skill in the art to make and use the claimed invention. In re Wright, 999 F.2d 1557, 1561, 27 U.S.P.Q.2d 1510 (Fed. Cir. 1993). The purpose of the enablement requirement is to ensure that the inventor provides sufficient information about the claimed invention so that a person of ordinary skill in the field of the invention can make and use it without undue experimentation. Scripps Clinic & Research Foundation v. Genentech, 927 F.2d 1565, 1571 (Fed. Cir. 1991). Significantly, the Federal Circuit has held that "[t]he enablement requirement is met if the description enables any mode of making and using the claimed invention." Engel Indus. v. Lockformer Co., 946 F.2d 1528, 1533, 20 U.S.P.Q.2d 1300, 1304 (Fed. Cir. 1991) (Engel).

NEOCO has not pointed to any evidence in the record to show that the written description of melt spinning in the specifications of the Magnequench patents are not sufficiently clear as to enable a person with ordinary skill in the art to make and use the claimed invention. Moreover the administrative law judge finds that the specifications describe the making of the claimed magnets by melt-spinning. (CX-1, col. 4, line 18 to col. 5, line 32; CX-2, col. 7, line 13 to col. 8, line 48; CX-3, col. 3, line 26 to col. 4, line 45).

Based on the foregoing, the administrative law judge finds that NEOCO has not met its burden in establishing that the Magnequench patents are invalid under 35 U.S.C. § 112 for lack of failure to describe and enable that which is claimed.

VIII. Antitrust Violations and Patent Misuse

NEOCO has alleged that SSMC has violated the Sherman Antitrust Act and engaged in patent misuse.

A. Section 1 of the Sherman Antitrust Act

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Complainants argued that NEOCO has not met its burden of proof with respect to the basic elements of a Section 1 Sherman Act violation; that NEOCO has not established that complainants engaged in concerted behavior in violation of the antitrust laws; that NEOCO has not established that complainants conduct has had an adverse effect on competition; and that NEOCO has not established that it has suffered an "antitrust injury." (CPost 94-98).

The staff argued that NEOCO has presented no clear and convincing evidence that SSMC has violated Section 1 or 2 of the Sherman Antitrust Act; and that NEOCO has not proffered any evidence that it has been injured by any of the alleged violations. (SPostR at 31).

It is a "general rule that the party raising an affirmative defense has the burden of proof on the issue." Brunswick Bank & Trust Co. v. United States, 707 F.2d 1355, 1360 (Fed. Cir.

1983). Furthermore, the burden is on the respondent to prove patent misuse and antitrust affirmative defenses. Certain Mass Flow Devices and Components Thereof, USITC Inv. No. 337-TA-91, 1981 WL 178504, Order No. 8 (Feb. 20, 1981). Thus, NEOCO bears the burden of proving its affirmative defenses, including its defenses of patent misuse and antitrust violations.

The elements that must be established to prove a violation of Section 1 of the Sherman Act are: (1) a contract, combination, or conspiracy among two or more separate entities, (2) that unreasonably retrains trade, and (3) that has an effect on interstate or foreign commerce. American Ad Mgmt., Inc. v. GTE Corp., 92 F.3d 781, 788 (9th Cir. 1996). Moreover, a private party seeking to establish an antitrust violation must also show a fourth element, viz., that it has suffered an injury cognizable under the antitrust laws. Eastman Kodak Co. v. Goodyear Tire & Rubber Co., 114 F.3d 1547, 1557, 42 U.S.P.Q.2d 1737 (Fed. Cir. 1997) (Eastman Kodak), abrogated on other grounds, Cybor Corp. v. FAS Technologies Inc., 138 F.3d 1448, 46 U.S.P.Q.2d 1169 (Fed Cir. 1998). Thus, SSMC's conduct must satisfy four elements before a violation of the Sherman Antitrust Act can be found.

With respect to the first element, viz. concerted action, the Supreme Court, in Monsanto Co. v. Spray-Rite Service Corp., 465 U.S. 752 (1984), has stated that to maintain an antitrust claim, the claimant must produce evidence that:

> ...tends to exclude the possibility of independent action...That is, there must be direct or circumstantial evidence that reasonably tends to prove that [the parties] had a conscious commitment to a common scheme designed to achieve an unlawful objective.

Id. at 768 (Emphasis added). Thus, while NEOCO relies on SSMC's licensing agreements to establish concerted behavior, as a general proposition a patent license agreement does not in itself raise antitrust concerns. On the contrary, as the Justice Department and FTC have stated:

> Licensing, cross-licensing, or otherwise transferring intellectual property (hereinafter "licensing") can facilitate integration of the licensed property with complementary factors of production. This integration can lead to more efficient exploitation of the intellectual property, benefitting consumers through the reduction of costs and the introduction of new products. Such arrangements increase the value of intellectual property to consumers and to the developers of the technology. By potentially increasing the expected returns from intellectual property, licensing also can increase the incentive for its creation and thus promote greater investment in research and development.

U.S. DEP'T OF JUSTICE & FEDERAL TRADE COMM'N, ANTITRUST GUIDELINES FOR THE LICENSING OF INTELLECTUAL PROPERTY § 2.3 (1995) (ANTITRUST GUIDELINES), reprinted in APPENDIX E TO ABA ANTITRUST SECTION, ANTITRUST LAW DEVELOPMENTS (4th ed. 1997).

Moreover, the assertion that a patent license contains certain restrictions on the sale or use of the licensed product, even if true, likewise does not in itself support a finding of an antitrust violation. Thus, the Court in Mallinckrodt, Inc. v. Medipart, Inc., 976 F.2d 700, 703, 24 U.S.P.Q.2d 1173 (Fed. Cir. 1992) (Mallinckrodt) stated "with few exceptions . . . any conditions which are not by their very nature illegal with regard to this kind of property, imposed by the patentee and agreed to by the licensee for the right to manufacture or use or sell the [patented] article, will be upheld by the courts." Id. at 703, (quoting E. Bement & Sons v. National Harrow Co., 186 U.S. 70, 91 (1892)). In addition, patent holders act within their rights when they impose filed of use restrictions on the use of their inventions. In General

Talking Pictures Corp. v. Western Electric Corp., 305 U.S. 124 (1938), a patent owner issued a license to sell amplifiers for certain specified uses. The licensee violated the restriction by selling to an unauthorized purchaser. The Supreme Court upheld the restriction, and found the licensee liable for infringement. Id. at 127. Furthermore, a patent owner enjoys the right to decide whether to license and on what terms it will license. Genentech v. Eli Lilly Co., 998 F.2d at 931, 949, 27 U.S.P.Q.2d 1241 (Fed. Cir. 1993), cert. denied, 510 U.S. 1140 (1994) (Genentech), Continental Paper Bag Co. v. Eastern paper Bag Co., 210 U.S. 405, 429 (1908) (Continental).

The administrative law judge rejects NEOCO's argument that United States v. Univis Lens Co., 316 U.S. 241, 249 (1942) (Univis) supports its argument that it is inappropriate for SSMC{

} (Tr. at 2174, NPost at 85).

Univis stands for the proposition that the unconditional sale of a patented product will exhaust the patent owner's rights with respect to that patent. Univis never addressed, and specifically reserved the question, whether the sale of one product could exhaust a patent owner's rights in a separate invention. Id. at 248. SSMC holds separate patent claims for both the alloy and the finished magnets. Thus, the administrative law judge finds that Univis does not stand for the proposition that SSMC would not be able to exact a separate royalty payment for each separate invention. Moreover, the law is clear that each separate patent claim "must be considered as defining a separate invention." Jones v. Hardy, 727 F.2d 1524, 1528, 220 U.S.P.Q. 1021 (Fed. Cir. 1984) (Jones). Also, the Court in Spindelfabrik Suessen-Schurr v. Sachubert & Salzer Maschinenfabrik AG, 829 F.2d 1075, 4 U.S.P.Q.2d 1044 (Fed. Cir. 1987), cert. denied, 484 U.S. 1063 (1988) (Spindelfabrik) stated:

> [P]atent license agreements can be written to convey different scopes of promises not to sue, e.g. a promise not to sue under a specified patent or, more broadly, a promise not to sue under any patent the licensor now has or may have in the future.

Id. at 1081(Emphasis added). Accordingly, the decision to grant a patent license limited to one invention, and to reserve rights in another invention, or license those rights to another party, is one of the privileges conferred on a patent owner.

Based on the foregoing, the administrative law judge finds that NEOCO has not established the first element of a Section 1 Sherman Antitrust violation, viz. that SSMC has engaged in a contract, combination, or conspiracy among two or more entities designed to achieve an unlawful objective.

With respect to the second and third elements, viz. unreasonable restraint of trade, that has an effect on interstate or foreign commerce, the Supreme Court, in Jefferson Parrish Hosp. v. Hyde, 466 U.S. 2 (1984), held that "[w]ithout a showing of actual adverse effects on competition, the respondent cannot make out a case under the antitrust laws..." Id. at 31. In meeting this standard the claimant must show "that the challenged action has had an actual effect on competition as a whole in the relevant markets; to prove it has been harmed as an individual competitor will not suffice." Capital Imaging Assoc. v. Mohawk Valley Med. Assoc., Inc., 996 F.2d 537, 543 (2d. Cir), cert. denied 510 U.S. 947 (1993). Moreover, conclusory assertions that a party's behavior had an adverse effect on competition are insufficient to meet this element. Levine v. Central Florida Med. Affiliates, Inc., 72 F.3d 1538, 1551 (11th Cir.), cert. denied, 519 U.S. 280 (1996).

NEOCO argued in its post hearing brief that there has been an anti-competitive effect on the market due to SSMC's licensing scheme. However the administrative law judge can find no evidence in the record that establishes that there has in fact been an anti-competitive effect on the Nd-Fe-B market. Absent any indication in the record that there has been an anti-competitive effect on the Nd-Fe-B market the second and third elements of an antitrust violation cannot be satisfied.

Regarding the fourth element, viz., that a private party seeking to establish an antitrust violation must also show that it has suffered an injury cognizable under the antitrust laws, the "antitrust injury" must be a result of the alleged anti-competitive conduct. Thus, in Eastman Kodak, the Federal Circuit rejected an antitrust claim on the ground that any injury the antitrust claimant may have suffered was the result of the legitimate enforcement of patent rights, and not the result of conduct that violated the antitrust laws. Id. 117 F.3d at 1557-1558. Accordingly, NEOCO must establish that any injury it suffered was the result of complainants' anti-competitive conduct and not the result of complainants' legitimate enforcement of its patent rights.

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}the administrative law judge can find no evidence in the record that establishes that NEOCO has suffered any injury as a result of complainants' anti-competitive actions. See Eastman Kodak supra. Furthermore the administrative law judge can find no case law to support NEOCO's argument (Tr. at 2183) that a showing of injury is unnecessary when one asserts an antitrust violation as an equitable affirmative defense. Moreover, NEOCO's counsel admitted that NEOCO has not suffered any "antitrust injury." Thus, in closing argument, NEOCO's counsel stated:

> With regard to injury, it's the Complainants' position and the Staff's position that NEOCO must show injury here, but this is not a case on which NEOCO has affirmatively asserted, either privately, through an Attorney General or the Department of Justice, that they have suffered an antitrust injury such that they would be entitled to prevail under these antitrust laws. [Emphasis added]

Based on the foregoing, the administrative law judge finds the NEOCO has not met is burden of proof in establishing its allegation, either prima facie or under the rule of reason that SSMC has violated Section 1 of the Sherman Antitrust Act.

B. Section 2 of the Sherman Antitrust Act

In asserting a violation of Section 2 of the Sherman Antitrust Act against SSMC, NEOCO relies on the same arguments as it relied in asserting a Section 1 violation. (NPost at 80-103).

Both complainants and the staff argued that NEOCO has not established the basic elements of a section 2 violation. (CPost at 99-103, SPostR at 31).

In order to prevail on a Section 2 of the Sherman Act claim, the claimant must establish: (1) the possession of monopoly power in the relevant market; (2) the willful acquisition or maintenance of that power as distinguished from growth or development as a consequence of a superior product, business acumen, or historic accident; and (3) causal antitrust injury. Eastman Kodak Co. v. Image Technical Services, Inc., 504 U.S. 451, 481 (1992). To prevail on a Section 2 attempted monopolization claim, the claimant must establish: (1) predatory or anti-competitive conduct; (2) a specific intent to monopolize; (3) a dangerous probability of achieving monopoly power; and (4) causal antitrust injury. Spectrum Sports, Inc. v. McQuillan, 506 U.S. 447, 456 (1993).

Moreover, the Federal Circuit, like other courts, has imposed strict requirements with respect to claims under Section 2 of the Sherman Act. For example, in American Hoist & Derrick Co. v. Sowa & Sons, Inc., 725 F.2d 1350, 1366, 220 U.S.P.Q. 763 (Fed. Cir.), cert. denied, 469 U.S. 821 (1984) (American Hoist), the court held that "proof of a relevant market is requisite to a holding that 15 U.S.C. § 2 has been violated." Id. at 1366. The Court further stated "[o]f course, should [the party alleging a Section 2 violation]. . . fail to offer proof of a relevant market and a dangerous probability of success of monopolization, the claim should again be dismissed." Id. at 1367.

With respect to elements one and two of a Section 2 violation, viz. the possession of monopoly power in the relevant market and the willful acquisition or maintenance of that power as distinguished from growth or development as a consequence of a superior product, business acumen, or historic accident, the antitrust claimant must demonstrate that a party has improperly derived or maintained monopoly power in that market, i.e., the party's market position is not the result of a superior product or other legitimate cause. The Federal Circuit has been strict on this issue also. In American Hoist, for example, a claimant asked the court to hold that fraudulent procurement of a patent constituted a violation of Section 2 of the Sherman Act. The court refused, noting that patents are not "monopolies" in the antitrust sense of the word. Rather, the court held that, even where a patent has been procured by inequitable conduct, a consideration of the specific elements of Section 2 was required before an antitrust violation could be found. Id. 725 F.2d at 1367.

While NEOCO's Section 2 argument also relies on SSMC's licensing practices (as discussed supra), licensing and cross-licensing agreements are not suspect under the antitrust laws. As stated supra, the antitrust laws, like the patent laws, grant patent owners considerable freedom to license their inventions. That freedom extends to the question of whether to license, with whom to license and, so long as the patent owner stays within the patent grant, on what terms to license. Genentech, 998 F.2d at 949. The "right to select [patent] licensees" and the "pursuit of optimum royalty income, are not themselves acts in restraint of trade." Id.; See also 1 ANTITRUST LAW DEVELOPMENTS 957 ("A patent owner has the right to exploit his invention by requiring royalty payments, and, in general, he may charge as high a royalty as he can obtain."). The Supreme Court has long recognized a patentee's freedom to choose its licensees: "As to the suggestion that competitors were excluded from the use of the new patent, we answer that such exclusion may be said to have been of the very essence of the right conferred by patent . . . without question of motive." Continental, 210 U.S. at 429.

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NEOCO argued that SSMC has attempted to monopolize an unspecified market by {

} and monopolization of the market through letters to numerous manufacturers and importers threatening action for infringement. (NPost at 98-100, NPostR at 18). However, the Federal Circuit has made clear that action in defense of one's patent rights does not constitute an antitrust violation. See Virginia Panel Corp. v. MAC Panel Co., 133 F.3d 860, 873, 45 U.S.P.Q.2d 1225, (Fed Cir.1997), cert. denied,119

S.Ct. 52 (1998) ("The antitrust laws do not preclude patentees from putting suspected infringers on notice of suspected infringement. . . . [A] patentee may lawfully police a market that is effectively defined by its patent"). Thus, the administrative law judge finds that complainants are within their rights when they have raised issues concerning possible infringement of their patents, and when they have addressed those issues to parties who trade in products apparently covered by their patents.

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}NEOCO has pointed to no evidence in the record that complainants have attained monopoly power in a relevant market, or that such power was obtained illegally. Absent any indication in the record that complainants have achieved monopoly power, a Section 2 violation cannot be established.

Regarding the third element, viz. antitrust injury, as discussed supra, NEOCO's counsel has admitted that it cannot show antitrust injury nor can the administrative law judge find any evidence in the record concerning antitrust injury.

With respect to the definition of the relevant market, NEOCO has offered no evidence by which to delineate the requisite relevant market for antitrust purposes. Thus, even assuming arguendo that SSMC has complete control over production and distribution of Nd-Fe-B magnets, the administrative law judge, on the record in this investigation, cannot make a determination that SSMC has a monopoly in the relevant market because it is quite possible that there are other rare earth magnets that compete with Nd-Fe-B magnets over which complainants have no control. Therefore, under the principle of American Hoist, which requires the definition of the relevant market, NEOCO's claim cannot stand.

Based on the foregoing, the administrative law judge finds that NEOCO has not met its burden of proof in establishing that SSMC has violated Section 2 of the Sherman Antitrust Act.

C. Patent Misuse

NEOCO argued that SSMC relies on a "sham distinction" in its patent claims; that the Nd-Fe-B alloy and magnets covered by the SSMC patents are not patentably distinct because there is no use for the alloy other than to make the finished magnet; that, as a result,{ }that this licensing "scheme" broadens the scope of SSMC's patent grant; and that, therefore, SSMC has engaged in patent misuse. (NPost at 86-92).

Complainants argued that NEOCO has not established that there is no use for the alloy other than to make the finished magnet; that SSMC{ } that SSMC has not impermissibly broadened the scope of its patent rights; and that there has been no anti-competitive effect on the market as a result of SSMC's behavior. (CPostR at 69-71).

The staff argued that SSMC's licensing arrangements are not inconsistent with the scope of it patent rights; that SSMC is free to{ }and that there has been no anti-competitive effect on the market as a result of SSMC's behavior. (SPostR at 69).

Patent misuse occurs when a patentee acts to extend the economic benefit of a patent beyond the scope of the patent grant, with anti-competitive effect. <u>C.R. Bard, Inc. v. M3 Systems, Inc.</u>, 157 F.3d 1340, 1372, 48 U.S.P.Q.2d 1225, (Fed. Cir. 1998), <u>cert. denied</u>, 1999 WL 184166 (May 24, 1999). Accordingly, to assert successfully the patent misuse defense "requires that the alleged infringer show that the patentee has impermissibly broadened the physical or temporal scope of the patent grant with anticompetitive effect." Virginia Panel Corp. v. MAC Panel Co., 45 U.S.P.Q.2d 1225 (Fed. Cir. 1997), cert. denied, 119 S.Ct. 52 (1998) (Virginia Panel).

Courts have identified certain conduct as being patent misuse per se, for example, "tying" arrangements or requiring the licensee to pay royalties after the expiration of the patent term. See Virginia Panel at 1232. Also, Congress has established that certain specific practices may not support a finding of patent misuse. Thus, 35 U.S.C. § 271 (d) reads in part:

> No patent owner otherwise entitled to relief for infringement or contributory infringement of a patent shall be denied relief or deemed guilty of misuse or illegal extension of patent right by reason of his having done one or more of the following...
>
> (3) sought to enforce his patent rights against infringement or contributory infringement, (4) refused to license or use any rights to the patent...

Id. When a practice alleged to constitute patent misuse is neither per se patent misuse, as described in Virginia Panel, nor specifically excluded from misuse analysis by § 271(d), supra, a court must determine if that practice is reasonably within the patent grant. See Virginia Panel at 1232, see also Mallinckrodt 976 F.2d at 1179-1180.

NEOCO has not alleged any per se patent misuse practices. Thus, under the reasoning set forth by the Federal Circuit in Virginia Panel, the administrative law judge must determine whether SSMC's actions are not specifically excluded from the realm of patent misuse by 35 U.S.C. § 271, and if not, the administrative law judge must determine whether or not the alleged practice has the effect of extending the patentee's statutory rights and does so with an anti-competitive effect.

With respect to NEOCO's argument that SSMC's practice of licensing only certain entities and not licensing other entities constitutes patent misuse, 35 U.S.C. § 271(d) (3)-(4) specifically excludes the refusal "to license or use any rights to the patent" as a basis for patent misuse. Thus, the fact that SSMC licenses {

}cannot form the basis of a patent misuse defense. Moreover, under Jones and Spindelfabrik, as discussed supra, said licensing practice is well within SSMC's patent rights.

With respect to other practices, NEOCO argued that SSMC expands its patent rights beyond the scope of its patent protection{

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Based on the foregoing the administrative law judge finds that SSMC has not impermissibly broadened the scope of its patents by preventing licensees{

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NEOCO also argued that SSMC's practice of licensing{

} (NPost at 91). However, as discussed supra, with respect to antitrust violation, SSMC holds separate claims{

}and a patentee is free to license certain inventions to one party and other inventions to another party, or not license them at all. See Jones supra, and Spindelfabrik supra. Furthermore, the only evidence which NEOCO cites to support the proposition is the written testimony of Bohlmann. (Tr. at 2174). However, NEOCO did not cite to any specific testimony of Bohlmann, and the administrative law judge cannot find, in the testimony of Bohlmann, any support for said proposition. Based on the foregoing, the administrative law judge finds that SSMC's practice{ } does not impermissibly expand the scope of its patent rights.

In addition, NEOCO has not pointed to any evidence in the record that shows that SSMC's practices have resulted in an anti-competitive effect, as is required to establish a patent misuse defense. See Virginia Panel, supra. Not only has NEOCO failed to offer proof of anti-competitive effect, but as stated supra, NEOCO has admitted that it cannot show any anti-competitive effect.

The administrative law judge rejects NEOCO's argument that the patent misuse analysis does not require an analysis of anti-competitive effect, citing the district court case Berlenbach v. Anderson & Thompson Ski Co, 329 F.2d 782 (C.A. Wash 1964) (Berlenbach). (NPost at 87). The Federal Circuit in Virginia Panel, a case which was some years after Berlenbach, specifically addressed the issue and stated that if the alleged practice "has the effect of extending the patentee's statutory rights and does so with an anti-competitive effect that practice must be analyzed under the rule of reason." Id. at 1232. (Emphasis added)

Based on the foregoing, the administrative law judge finds that NEOCO has not met its burden of proof in establishing that SSMC has engaged in patent misuse.

IX. Inequitable Conduct

NEOCO argued that the patents in issue are invalid due to inequitable conduct by the complainants before the U.S. Patent and Trademark Office (PTO). (NPost at 73-78).

Complainants argued that they did not engage in inequitable conduct before the PTO. (CPost at 89).

The staff argued that NEOCO has abandoned its inequitable conduct defense by failing to address it in its posthearing brief and failing to present any relevant evidence at hearing. (SPostR at 31).

A patent is held unenforceable based on inequitable conduct when an applicant breaches his duty of candor by (1) withholding from or misrepresenting material information to the patent examiner (2) with an intent to deceive or mislead, both of which must be proven by clear and convincing evidence. Kingsdown Medical Consultants, Ltd. V. Hollister, Inc., 863 F.2d 867, 872, 9 U.S.P.Q.2d 1384, 1399 (Fed. Cir. 1988), cert. denied, 490 U.S. 1067 (1989) (Kingsdown).

NEOCO, in its prehearing brief, had raised the issue of whether the patents at issue are unenforceable due to inequitable conduct before the PTO by failing to bring certain technical articles to the attention of the examiner during the prosecution of the applications. (NEOCO Prehearing Brief at 49). However, NEOCO presented no evidence a hearing that would demonstrate how the technical references it relied upon in its prehearing brief would have been material to the prosecution of the applications. In fact NEOCO, in its posthearing submissions, did not attempt to apply the standard set forth in Kingsdown to any technical references. Moreover in Section IV, supra, the administrative law judge found that the claimed subject matter in issue is not invalid based on the prior art NEOCO has relied upon, much of which was before PTO.

With respect to NEOCO's inequitable conduct arguments concerning patent misuse and antitrust violations, each of those has been discussed, supra, as separate invalidity defenses, and are not elements of an inequitable conduct defense. With respect to NEOCO's inequitable conduct argument regarding inventorship, the administrative law judge has found that inventorship is correct on the '395 patent. See Section V supra. Furthermore, NEOCO's allegations concerning the misappropriation of Koon's invention has been discussed, in Section IV A, supra.

Based on the foregoing, the administrative law judge finds that NEOCO has not met its burden in establishing that complainants engaged in inequitable conduct before the PTO in the prosecution of the applications for the patents in issue.

X. Unfair Acts and Unlawful Methods of Competition

NEOCO argued that the complainants have engaged in unfair acts and unlawful methods of competition. (NPost at 78-80). Specifically, NEOCO argued that complainants have permeated the marketplace with threatening correspondence to consumers, distributors and manufacturers, misrepresenting the patent situation; that such letters have had an anti-competitive effect on the market (NPost at 78); that complainants only named respondents whom complainants knew would be unable to mount a vigorous defense (NPost at 79); that complainants failed to name Keem as an inventor of the '395 patent (NPost at 80); that complainants have allowed its licensees to mislead purchasers of licensed material about the scope of the licenses; and that complainants' licenses are unfair and unlawful. (NPost at 80).

Both complainants and the staff argued that complainants have not engaged in any unfair acts or unlawful methods of competition. (CPost at 109, SPost at 70).

The Federal Circuit, in Zenith Electronics Corporation v. Exec. Inc., 51 U.S.P.Q.2d 1337, stated:

> The only basis for a federal unfair competition claim is Section 43(a) of the Lanham Act. § 15 U.S.C. 1125(a)(1) (1994). That provision prohibits false designations of origin or false or misleading descriptions of goods or services which are likely to cause confusion.

Id. Thus, since NEOCO has not alleged false designations of origin or false or misleading descriptions of goods or services which are likely to cause confusion, NEOCO's unfair competition and unlawful acts defense must be analyzed under the common law of unfair competition. The Third Restatement of Unfair Competition § 1 states that, as a general principal of unfair competition, one must cause harm to the commercial relations of another.

With respect to NEOCO's argument that complainants have permeated the market place with threatening letters to consumers, distributors and manufacturers, as discussed supra with respect to antitrust violations, it is well established that good faith warnings in defense of one's patents rights is within a patent owners rights. See Mallinckrodt, 976 F.2d 700, 709-710, 24 U.S.P.Q.2d 1173 supra, see also Virginia Panel, 133 F.3d 873, supra. Moreover, NEOCO has not pointed to any evidence in the record to establish that said correspondence was in fact inaccurate or misleading. In addition, as stated with respect to antitrust violations supra, NEOCO has admitted that it can show no injury as a result of complainants' conduct.

Regarding NEOCO's argument that complainants have engaged in unfair competition and unlawful acts due to the fact that they named only respondents they knew would not be able to mount a vigorous defense, NEOCO has pointed to no evidence in the record that shows that complainants had sufficient evidence regarding infringement by any entities not named in the complaint. Also, NEOCO has not shown how such failure to name any other entities in this investigation has harmed NEOCO.

NEOCO's argument that complainants' licenses are unlawful and unfair are similar to its antitrust and patent misuse defense arguments. {

} Furthermore, NEOCO has admitted that it cannot show any injury as a result of complainants' licensing practices.

With respect to NEOCO's argument that complainants have allowed its licenses to mislead others concerning the scope of the license, said argument is merely a conclusory statement and NEOCO did not cite to any evidence in the record to support this allegation.

Absent any evidence whatsoever concerning allegations that complainants' licensees have misled purchasers, the administrative law judge cannot find that such conduct amounts to unfair competition.

NEOCO argued that complainants failed to name Keem as an inventor of the '395 patent. However the administrative law judge has found that inventorship of the '395 patent is correct. See Section V supra. Moreover NEOCO has cited no case law to support its proposition that a failure to name as an inventor rises to unfair competition or is an unlawful act.

Based on the foregoing, the administrative law judge finds that NEOCO has not met its burden in establishing that complainants have engaged in unfair competition or unlawful acts.

XI. Constitutional Issues

NEOCO argued that a determination adverse to NEOCO would violate both the substantive and procedural due process clauses of the U.S. Constitution because it has been hauled into court to defend a "class" of infringers, even though the procedural safeguards of FRCP 23, which governs class actions, have not been applied in this investigation. (NPost at 116). NEOCO further argued that the remedy complainants seek would constitute a regulatory taking under the Fifth Amendment of the U.S. Constitution because the remedy would take NEOCO's "property rights" under the U.S. Navy patents without due process or just compensation. (NPost at 116, 117).

Both complainants and the staff argued that FRCP 23 does not apply to Section 337 investigations and that a Section 337 investigation is not a Fifth Amendment taking. (CPostR at 82, SPostR at 33).

Congress, in enacting Section 337, has specifically provided that the Commission may issue a general exclusion order under certain circumstances. 19 U.S.C. § 1337(d)(2). There is no provision in § 1337(d)(2) for certification of a class prior to issuance of an exclusion order. Moreover, the Commission rules, not the rules of Federal Civil Procedure, constitute binding authority in Section 337 investigations and the Commission rules provide for adequate notice to named respondents. There is no requirement in the Commission rules, or in the ground rules in force in this investigation, that the complainants must seek certification of a class of respondents, or notify any person that may full into such class. Furthermore, NEOCO has cited no case law to support its proposition that a class must be certified pursuant to FRCP 23 in order to carry out a Section 337 investigation.

Referring to NEOCO's "property rights" under the Navy licenses, said rights do not extend to the infringement of other patents. Moreover, the Navy license only gives NEOCO the right to exclude others from practicing the inventions of the Navy patents. See Spindelfabrik, 829 F.2d at 1081.

Based on the foregoing, the administrative law judge finds that a determination adverse to NEOCO does not implicate substantive and procedural due process concerns of the U.S. Constitution and that relief under section 337 does not constitute a regulatory taking under the Fifth Amendment of the U.S. Constitution.

XII. Remedy

Complainants request the issuance of a general exclusion order and the issuance of cease and desist orders as to A.R.E., NEOCO, Harvard and Multi-Trend. (CPost at 117-138). It is argued that a general exclusion order is a necessary and proper remedy in this investigation (CPost at 117); that the record in this investigation warrants a requirement that importers of certain downstream, viz. speakers, headphones and motors, products certify that their products do not contain infringing Nd-Fe-B magnets (CPost at 130); and that to ensure complainants receive complete and adequate relief, importers of motors, generators, certain electronic products and rare earth metals should be required to certify that their import shipments are not Nd-Fe-B magnets or magnetic materials. (CPost at 134).

NEOCO, in opposition to the complainants' request for a general exclusion order, argued that NEOCO's magnets are distinguishable at United States Customs; that NEOCO's imports are labeled using a sequential, coded labeling system, that is strictly monitored as required by the United States Navy; that a general exclusion order, while curtailing rogue importers, would reach to far by denying the U.S. market of products available under the Navy's U.S. patents; and that such a limitation prevents U.S. customers from obtaining competitive pricing that would result from normal competition. (NPost at 112).

The staff argued that a general exclusion order is required to provide an adequate remedy (SPost at 76); that in light of the disruption of trade in legitimate goods, a downstream certification procedure is not warranted (SPost at 79); and that the staff does not support cease and desist orders against any of the respondents. (SPost at 79).

A. General Exclusion Order

With respect to the issuance of a general exclusion order, in Certain Airless Paint Spray Pumps and Components Thereof, Inv. No. 337-TA-90, USITC Pub. 1199 at 17, 216 U.S.P.Q. 465, 472-73 (1981) (Spray Pumps) a general exclusion order was deemed appropriate when there is proof of (1) a widespread pattern of unauthorized use of the patented invention, and (2) certain business conditions from which one might reasonably infer that foreign manufacturers other than respondents to the investigation may attempt to enter the U.S. market. Id.

In 1994, statutory standards on the issuance of general exclusion orders were adopted in the amendments to Section 337, adding a new subsection to Section 337(d) that states:

> (2) The authority of the Commission to order an exclusion from entry of articles shall be limited to persons determined by the Commission to be violating this section unless the Commission determines that --
>
> > (A) a general exclusion from entry of articles is necessary to prevent circumvention of an exclusion order limited to products of named persons; or
> >
> > (B) there is a pattern of violation of this section and it is difficult to identify the source of infringing products.

19 U.S.C. § 1337(d)(2) (effective January 1, 1995); see also Commission rule 210.50(c) (incorporating the statutory standards into the Commission rules). Those standards "do not differ significantly" from the Spray Pumps standards. Certain Neodymium-Iron-Boron Magnets, Inv. No. 337-TA-372, Commission Opinion on Remedy, the Public Interest and Bonding at 5 USITC Pub. No. 2964(1996) (Magnets). See also Certain Agricultural Tractors, Inv. No. 337-TA-380, 44 U.S.P.Q.2d 1385, 1397-1404 (1997) (General exclusion order granted) (Tractors).

In Spray Pumps, the Commission pointed out that a complainant

> should not be compelled to file a series of separate complaints against several individual foreign manufacturers as it becomes aware of their products in the U.S. market. Such a practice would not only waste the resources of the complainant, it would also burden the Commission with redundant investigations. (Comm'n Op. at 30).

That consideration must be balanced against the potential of a general exclusion order to disrupt legitimate trade. Id. With this balance in mind, the Commission concluded that it would

> "require that a complainant seeking a general exclusion order prove both a widespread pattern of unauthorized use of its patented invention and certain business conditions from which one might reasonably infer that foreign manufacturers other than the respondents to the investigation may attempt to enter the U.S. market with infringing articles." Id.

The Commission in Spray Pumps then set out the following factors as relevant in demonstrating whether there is a "widespread pattern of unauthorized use":

> (1) a Commission determination of unauthorized importation into the United States of infringing articles by numerous foreign manufacturers;
>
> (2) the pendancy of foreign infringement suits based upon foreign patents which correspond to the domestic patent at issue; and
>
> (3) other evidence which demonstrates a history of unauthorized foreign use of the patented invention.

Id. The Commission also identified the factors relevant to showing "certain business conditions" as including:

> (1) an established market for the patented product in the U.S. market and conditions of the world market;
>
> (2) the availability of marketing and distribution networks in the United States for potential foreign manufacturers;
>
> (3) the cost to foreign entrepreneurs of building a facility capable of producing the patented article;
>
> (4) the number of foreign manufacturers whose facilities could be retooled to produce the patented article; or
>
> (5) the cost to foreign manufacturers of retooling their facility to produce the patented article.

Id. at 31-32.

Moreover, when determining the proper recommendation for a remedy, it is appropriate for the administrative law judge to consider evidence regarding respondents who have been terminated from the investigation on the basis of Consent Orders. Thus, the Commission has considered evidence of respondents who have been terminated from the investigation on the basis of Consent Orders. In Magnets the administrative law judge considered evidence regarding respondent Tridus, which had entered into a Consent Order earlier in the proceeding. The administrative law judge stated that the Consent Order made it clear that it did not "preclud[e] further remedial action," and concluded that it would be appropriate to "consider evidence relating to Tridus samples as relevant to the remedy issue." Magnets, Comm'n Op. at 21, fn. 18. In Woodworking Machines, Inv. No. 337-TA-174, USITC Pub. 1979 at 49 (1987), the Commission considered evidence regarding terminated respondents that had entered into Consent Orders in finding a pattern of widespread unauthorized use of the complainant's patents and trademarks. Also, in Certain Compact Multipurpose Tools, Inv. No. 337-TA-416, Unreviewed Final Initial and Recommended Determinations at 24-30 (1999) (Tools), the administrative law judge found a widespread pattern of unauthorized use based, inter alia, on evidence regarding sales by a respondent which had entered into a Consent Order in the proceeding. Furthermore, in addition to Commission precedent, ¶6 of the Consent Orders signed by those terminated respondents provides that:

> [the respondent] understands and acknowledges that with regard to information it provided in the course of discovery in the Investigation, including but not limited to documents, interrogatory responses, transcripts of sworn deposition testimony, and sample

> magnets, Complainants may seek to introduce such information as evidence in the Investigation after [the respondent] has been terminated as a respondent.

See Notice Of A Commission Determination Not To Review An Initial Determination Terminating One Respondent On The Basis Of Consent Order; Issuance Of Consent Order (February 1, 1999), and Notice Of A Commission Determination Not To Review Two Initial Determinations Terminating Four Respondents On The Basis Of Consent Orders; Issuance Of Consent Orders (February 9, 1999).

The administrative law judge finds that there is a widespread pattern of unauthorized use of the patented invention. Thus, each of former respondents AUG, CYNNY, Houghes, IMI, and H.T.I.E., have imported, sold for importation, or sold after importation articles that infringe the patents in issue. (FF 241, 264). Also, each of respondents ARE, NEOCO, High End, Harvard, Beijing Jing Ma, Xin Huan and Multi-Trend have imported, sold for importation, or sold after importation articles that infringe the patents in issue See supra, see also Certain Rare Earth Magnets and Magnetic Materials and Magnetic Materials and Articles Containing Same, Inv. No. 337-TA-413, Notice of Commission Determination Not To Review An Initial Determination Granting Summary Determination On The Issue Of Importation (May 25, 1999). Also third parties, viz., GEC and AIWA have imported infringing magnets. (FF 270-271).

Moreover, there is evidence that there are numerous foreign manufacturers. For example, NEOCO has conceded that it imports Nd-Fe-B magnets and magnetic materials from at least five different companies in china. (FF 370). Also, AUG acknowledged that it has imported magnets from at least one company in China, and AUG's invoices show that it has imported Nd-Fe-B magnets from three other Chinese companies. (FF 371). In addition, the evidence shows that

H.T.I.E. has imported from three Chinese sources. (FF 372).

Furthermore, information obtained through discovery by complainants and from public sources identified by respondents uncovered numerous non-respondent companies that manufacture, sell for importation, or sell after importation to the United States Nd-Fe-B magnets and magnetic materials. For example, a search on the Internet using the keyword "neodymium" retrieved web-sites for numerous companies offering to sell Nd-Fe-B magnets in the United States. (FF 372). Similarly, the Thomas Register, a trade publication commonly used by those in the magnet industry, contains listings from a substantial number of U.S. companies dealing in Nd-Fe-B magnets and magnetic materials. (FF 374).

The testimony of fact witnesses also confirms that the subject magnets themselves have no identifying marks from which one can establish their source by visual inspection. (FF 381). Also, in the case of imports from China, the lack of identifying marks on the magnets themselves can completely mask the identity of the manufacturer since the import shipment usually is from a trading company and not the manufacturer itself. (FF 375-381). However, the administrative law judge finds that with respect to the magnets imported and sold by NEOCO, said magnets are specifically labeled, NEOCO can be easily identified as the manufacturer, and the destination of said magnets can be easily tracked. (FF 382).

With regard to the "certain business conditions" which constitute the second prong of the Spray Pumps test, the administrative law judge finds that at least two of the factors or "business conditions" are satisfied.

With respect to the first factor of "certain business conditions," viz., the existence of an established market for the patented product in the U.S. market and conditions of the world market, the administrative law judge finds that there is testimony that there is an established demand for Nd-Fe-B magnets in the United States. (FF 383-389). There is also evidence that Nd-Fe-B magnets are key components in a number of popular and/or economically important products, such as computer hard drives, magnetic resonance imagers, automobiles, a variety of industrial motors and numerous consumer electronic products. (FF 385-387).

Regarding the second factor, viz. the availability to foreign manufacturers of U.S. marketing and distribution networks, the administrative law judge finds that there is evidence that the channels available for the importation and distribution of infringing Nd-Fe-B magnets and magnetic materials are numerous and significant. Testimony confirms that a number of firms in the U.S., some large, some little more than sole proprietorships, are engaged in the importation and distribution of Nd-Fe-B magnets and magnetic materials in the United States. (FF 390-397). Some, such as NEOCO, H.T.I.E. and A.U.G., have imported Nd-Fe-B magnets and/or magnetic materials from a number of Chinese sources. (FF 370, 371, 372). Others, such as Harvard, have an established relationship with a single foreign source. (FF 393). Three of the respondents (CYNNY, A.R.E. and I.M.I.) had engaged in distribution and sale of magnets imported by others (including respondents A.U.G.,{ } and Houghes). (FF 394). CYNNY also has engaged in the distribution and sale of magnets imported by another firm not named as a respondent. (FF 396). Likewise, CYNNY and A.R.E. have also imported Nd-Fe-B magnets directly from Chinese manufacturers. (FF 379, 395, 398).

In addition, the administrative law judge finds that the information needed for an Nd-Fe-B magnet and magnetic materials importer/distributor to establish sources of supply and a customer base is readily available. Respondents have testified in depositions that they and other Nd-Fe-B magnet importers, distributors, and marketers make use of various resources to market the Nd-Fe-B magnetic products. (FF 399-402). For example, the Thomas Register is a well-known medium for advertising Nd-Fe-B magnetic products, and for identifying firms that are likely to be purchasers of Nd-Fe-B magnets and magnetic materials. (FF 374). Other trade magazines also carry advertisements for Nd-Fe-B magnets and magnetic materials. (FF 401). These publications serve as a source of information for foreign manufacturers of Nd-Fe-B magnets, such as those in China, who seek to identify U.S. importers, distributors, and marketers for their products. They also serve as a resource for importers and distributors to find customers. (FF 402). Magnet conferences, such as the China Magnet '98 Conference (CX-413), also serve as a vehicle for new entrants into the business to identify potential U.S. importers, marketers, and distributors. (FF 399, 403).

While the administrative law judge has found no evidence in the record specifically regarding the third factor, viz., the cost to foreign entrepreneurs of building a facility capable of producing the patented article, the administrative law judge finds that there is evidence that there already exists a large number of other foreign, particularly Chinese, manufacturers of Nd-Fe-B magnets with substantial production capacity. Thus, testimony from witnesses places the number of Nd-Fe-B magnet factories in China at over 100. (FF 404). Moreover, a consultant on the Chinese Nd-Fe-B magnet and magnetic materials industry reported earlier this year that over 100 factories in China manufacture these materials, and at least 15 of them have substantial production capacity (over 150 tons per year). (FF 404, 405). Respondent IMI has confirmed that it receives facsimiles regularly from Chinese Nd-Fe-B magnet manufacturers who want to sell their magnets in the United States. (FF 406).

Furthermore, the administrative law judge finds that the evidence confirms that a number of these foreign manufacturers have exported Nd-Fe-B magnets and magnetic materials to the United States. In fact, the testimony of a number of the importer respondents is that, in addition to the foreign manufacturers named as respondents in this investigation, they have imported magnets from a number of other foreign sources. (FF 398).

Concerning the fourth and fifth factors, viz, the number of foreign manufacturers whose facilities could be retooled to produce the patented article and the cost to foreign manufacturers of retooling their facility to produce the patented article, while the administrative law judge can find no evidence in the record with respect to the number of factories that can retool or the cost of retooling, the administrative law judge finds that there is evidence that such retooling can be easily done by factories that produce other types of magnets. Thus, in the October 12, 1998 deposition of Lin, a principal of Houghes, Lin testified that:

> Q. Let me ask you a question. Say a factory is making–what was the name of the–
>
> A. Alnico
>
> Q. What if they wanted to switch over and make neodymium-iron-boron?
>
> A. They can do it.
>
> Q. Is that easy?
>
> A. Yes, because the same metallurgical process.
>
> Q. It's easy for a factory to switch to maybe one type of the magnet or powder to another type of magnet, to make neodymium-iron-boron magnets or powders?
>
> A. Yes.

> Q. It's not difficult?
>
> A. No, because the process they have the vacuum induction melting, then they crush the alloy into powder, and then press it, and then sinter it. So, yes.

(CX-159, pp. 157-158).

In addition, the administrative law judge rejects NEOCO's argument that a general exclusion order would "reach to far by denying the U.S. market of products available under the Navy's U.S. patents." (NPost at 112). Specifically, NEOCO argued that any remedy should be tailored "to protect respondent NEOCO as an importer acting [as a licensee from the Navy] under three valid United States patents." (NPost at 112). However, NEOCO's status as a licensee has no bearing on its status as an infringer of the patents in issue in this investigation. NEOCO's license is nothing more than a promise by the Navy that it will not sue NEOCO for infringement of the Koon patents. The Federal Circuit, in Spindelfabrik Suessen-Schurr v. Schubert & Salzer Maschinenfabrik AG, 4 U.S.P.Q.2d 1044 (1987), cert. denied, 484 U.S. 1063 (1988), stated:

> As a threshold matter, a patent license agreement is in essence nothing more than a promise by the licensor not to sue the licensee...Even if couched in terms of '[l]icensee is given the right to make, use, or sell X,' the agreement cannot convey that absolute right because not even the patentee of X is given that right. His right is merely one to exclude others from making, using or selling X, 35 U.S.C. § 154. Indeed the patentee of X and his licensee, when making, using, or selling X, can be subject to suit under other patents.

Id. at 1048 (Emphasis added). Moreover Article VI of License No. NRL-LIC-98-12-049, between NEOCO and the Navy, provides in pertinent part: "LICENSOR makes no representation or warranty... that the exercise of the LICENSE will not result in the infringement of other patents. ...Nothing contained in this LICENSE shall be interpreted to grant to LICENSEE any rights with respect to any inventions other than the licensed inventions." (CX-233 at 600069). Thus, NEOCO's license from the Navy does not protect it from suit and remedy, under the Magnequench and SSMC patents.

Based on the foregoing, the administrative law judge recommends a general exclusion order as an appropriate remedy.

B. Certification of Downstream Products

With respect to a certification requirement for certain downstream products, the Commission has authority under section 337 to issue an exclusion order covering both the primary product manufactured by the named respondent as well as any downstream products of which it is a component part. Certain Erasable Programmable Read Only Memories, Components Thereof, Products Containing Such Memories, and Processes for Making Such Memories, ITC Inv. No. 337-TA-276, USITC Pub. 2196 Comm'n Op. at 118-31 (May 1989),(EPROMs), aff'd, Hyundai Electronics v. Int'l Trade Comm'n, 14 U.S.P.Q.2d 1396 (Fed. Cir. 1990) (Hyundai) and Certain Electrical Connectors and Products Containing Same, ITC Inv. No. 337-TA-374, USITC Pub. 2981 Comm'n Op. on Remedy at 7 n.8 (July 1996) (Connectors). However, in determining the proper scope of exclusion orders with respect to downstream products containing infringing products, the Commission balances the

> complainant's interest in obtaining complete protection from all infringing imports by means of exclusion of downstream products against the inherent potential of . . . a limited exclusion order when extended to downstream products, to disrupt legitimate trade in products which were not themselves the subject of a finding of violation of section 337.

Connectors, supra, at 7 citing EPROMs, supra, at 125. To this end, the Commission may consider such matters as the value of the infringing articles compared to the value of the downstream products in which they are incorporated, the identity of the manufacturer of the downstream products (i.e., are the downstream products manufactured by the party found to have committed the unfair act or by third parties), the incremental value to complainant of the exclusion of downstream products, the incremental detriment to respondents of the burdens imposed on third parties resulting from exclusion of downstream products, the availability of alternative downstream products which do not contain the infringing articles, the likelihood that imported downstream products actually contain the infringing articles and are thereby subject to exclusion, the opportunity for evasion of an exclusion order which does not include downstream products, and the enforceability by the U.S. Customs Service of an order covering downstream products. EPROMs at 125. Moreover, the Commission may identify and take into account any other factors which it believes bear on the question of whether to extend remedial exclusion to downstream products and if so to what specific product. Id.

In addition, exclusion of downstream products of non-respondent manufacturers has been the basis of Presidential disapproval of an exclusion order. See Certain Integrated Circuit Telecommunications Chips and Products Containing Same, Including Dialing Apparatus, Inv. No. 337-TA-337, USITC Pub. 2670 (Chips) Commission Opinion On The Issues Under Review And Remedy, The Public Interest, And Bonding at 32 (Aug. 1993). In Chips, on the basis of the record in that investigation, the Commission did believe that including certain products manufactured by non-respondents containing infringing tone dialer chips manufactured by "HMC"within the scope of an exclusion order was necessary to provide justified and effective relief. However, the Commission found that the record established that there were virtually no imports of tone dialer chips outside of downstream products into the United States. Id. at 30.

In Connectors the Commission determined that "[o]n the facts of this investigation", there was justification for exclusion of motherboards containing infringing electrical connectors; that while the actual value of the electrical connectors in relation to the value of the motherboard appeared to be small, the connectors were of significant value to the assembled product for reasons apart from their cost; that without the presence of such connectors, the motherboard was rendered useless as it was incapable of receiving memory cards; and that exclusion of motherboards was warranted to ensure that exclusion was effective Id. at 11.[59] The Commission however determined that it would be highly burdensome on

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[59] Connectors noted (Id at 13-14):

> We note that the proposed exclusion order would not extend to all downstream products that may contain infringing electrical connectors (e.g., computers), but only to those which account for the bulk of imports of infringing electrical connectors. In this respect, we believe that the order would comport with the concerns raised by USTR Kantor in reviewing the Commission's remedial orders in Certain Integrated Circuit Telecommunications Chips and Products Containing Same, Including Dialing Apparatus, Inv. No. 337-TA-337, wherein he indicated that:
>
>> orders affecting companies that import downstream products containing infringing components, but are not manufacturing the infringing product itself, must be crafted in the narrowest manner that can result in an effective order. Moreover, this issue must be addressed in a factual manner with appropriate support for the conclusion that the order presents the narrowest effective remedy.
>
> Letter from Michael Kantor, U.S. Trade Representative, to Don E. Newquist, Chairman, U.S.I.T.C. (September 8, 1993).

importers and Customs to require that all imports of motherboards either be certified as containing non-infringing electrical connectors or excluded and therefore agreed with the staff that it would be appropriate to limit the certification requirement by permitting Customs the discretion to determine when to require such certification. Id. at 15. In limiting the exclusion order, the Commission recognized Customs concerns regarding a broad bases exclusion order in the following:

> However, Customs indicated to the IA its view that a certification provision that required all importers of motherboards to certify that their products do not contain infringing Hon Hai/Foxconn connectors would be highly burdensome to the numerous importers of mother boards. Such a broad certification requirement also would burden Customs inasmuch as the certification procedure would entail the processing of large numbers of paper documents.

Id. at 10, (Emphasis in original). Moreover, like Chips, the record in Connectors established that there was evidence that the infringing connectors were imported only on motherboards and not imported outside of said downstream products. Id. at 8, 9.

With respect to both of complainants' proposed certification procedures, viz., (1) a requirement that importers of certain downstream products, namely speakers, headphones and motors, certify that their products do not contain infringing Nd-Fe-B magnets, and (2) a requirement that importers of motors, generators, certain electronic products and rare earth metals certify that their import shipments are not Nd-Fe-B magnets or magnetic materials, the administrative law judge finds that the danger of unduly disrupting legitimate trade through the proposed certification procedure appears considerable. Thus, while it appears that at least some magnets are imported under labels that do not make it clear that they are magnets (FF 407-413)[60], the proposed certification would effect third parties who do not manufacture the infringing goods. Under the proposed certification procedure all manufacturers of, for example, AC motor parts would be required to certify that they do not use infringing magnets even if their products contain no magnets at all, and that all manufacturers of gears, sprockets, motor housings, etc. would be required to certify that they do not use infringing magnets, notwithstanding the fact that gears, sprockets, etc. are not magnets. The administrative law judge finds complainants' proposed certification procedures are similar to the broad based certification procedure that Customs itself was concerned about in Connectors. Thus, like the broad based certification request in Connectors, the administrative law judge finds that the complainants' procedures would be "highly burdensome to the numerous importers" and would be highly burdensome to Customs in that it would "entail the processing of large numbers of paper documents." See Connectors at 10. Therefore, in light of the potential disruption of trade in legitimate goods that are not remotely connected with the patented magnets, and the burden on Customs the administrative law judge finds that such relief is not warranted.

Moreover, the enforceability of a downstream certification procedure that would require an importer to certify that its import shipment is not in fact magnets is suspect. In view of the evidence that some import shipments of magnets are mislabeled (FF 407-413), it is likely that those importers who mislabel their shipments would also be willing to make a false certification to Customs, thus making the certification procedure useless. In fact, the Commission has held that such a certification procedure would be ineffective in the Nd-Fe-B magnet market. In Magnets

[60] Such unidentifiable magnets would not include NEOCO's magnets as discussed supra.

the Commission stated:

> The willingness on the part of importers to misdescribe or mislabel goods to Customs suggests that they would be equally willing to falsify a certification to Customs. Thus, a general exclusion order which allowed certification would be ineffective at barring the entry of infringing Nd-Fe-B magnets, and thus, ineffective at affording complainant complete relief.

Magnets, at 11. Complainants argued that the decision in Magnets concerning the impropriety of a certification procedure does not preclude a certification procedure in this investigation because the "...certification issue in this case differs significantly from the certification issue addressed in the earlier magnets case..." (Tr. at 2102-2103). The administrative law judge agrees with complainants that the certification procedure requested in Magnets differs from the procedures requested in this investigation. In Magnets the certification procedure requested involved the importer certifying that its shipment contained non-infringing magnets based on it's own analysis, as opposed to the certification requested in this investigation that merely requires the importer to certify that its shipment is not in fact magnets at all. However, while there are differences in the certification procedures requested in Magnets and in this investigation, such differences do not bear on the Commission's premise that the willingness on the part of importers to misdescribe or mislabel goods to Customs suggests that they would be equally willing to falsify a certification to Customs. Thus, the administrative law judge does not see how said difference would alter an importer's willingness to falsify a certification.

Furthermore, the administrative law judge rejects complainants' argument that the decision in Chips supports a downstream certification procedure. (CPost 131-133). While complainants rely on their proposed findings of fact 807-808 and 832-838 for evidence that 50%-

60% of the Nd-Fe-B magnets manufactured in China go into downstream products and that these are products that are imported into the United States, the administrative law judge finds that those proposed findings of fact do not show whether or not those magnets go into the downstream products before or after importation into the United States or whether those magnets (if imported already inside a downstream product) represent virtually all of the infringing magnets that are imported into the Unites States. The administrative law judge finds that there is no evidence in the record to show that virtually all of the infringing magnets that are imported into the United States are imported as part of downstream products, as was the case with tone dialers in Chips and with electrical connectors in Connectors.[61]

The administrative law judge also rejects complainants' argument that the decision in Hyundai supports a downstream certification procedure in this investigation. Complainants argued that the reasons for requiring a downstream certification procedure are more compelling in this investigation than they were in Hyundai, and that it would be anomalous to not require downstream certification. (CPost at 132-133). The administrative law judge finds that the reasons for requiring a downstream certification in this investigation are not as compelling as

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[61] At the hearing complainants were asked by the administrative law judge if there was any evidence in the record that shows that a substantial portion of imported, allegedly infringing magnets are imported as parts inside of products such as speaker or motors. While complainants represented that "[w]e have presented evidence that the magnets are imported in downstream products," and that complainants do not know "that there's evidence regarding any particular quantification because I'm not sure that that evidence would be possible to get" on the ground that there is in issue a "diffuse" industry (Tr. at 2111-2112), the administrative law judge finds from the record that the industry is not so diffuse that evidence relating to at least a general quantification would be impossible. For example while complainants provided evidence that third parties GEC and AIWA imported downstream products with infringing magnets, complainant offered no evidence concerning the quantity of GEC's and AIWA's imports or how that quantity relates to the number of infringing magnets as a whole.

those in Hyundai. The Federal Circuit in Hyundai, in discussing the factors considered in determining the scope of an exclusion order with respect to downstream products as articulated in Eproms at 125, stated:

> The Commission's limited exclusion order requiring Hyundai to certify, as a condition of entry, that certain of its downstream products do not contain infringing EPROMs is a reasonable accommodation of these factors. The Commission found that Hyundai had violated section 337; that specific EPROM chips embodied the violation; that Hyundai remained free under its manufacturing agreement with General Instrument to use excess infringing EPROMs for its own requirements; and that Hyundai could easily assemble the infringing EPROMs into and import them as part of other Hyundai product "containers" that require EPROMs to function, including wafers, circuit boards, computer peripherals, telecommunications equipment, and automotive electronic equipment. It concluded that the certification provision "is a reasonable means of ensuring the effectiveness of the remedy to which Intel has proven itself entitled."[citation omitted]. We agree.

Hyundai at 1401, (Emphasis added). Significantly, the Federal Circuit noted that the Commission found that the party subject to the downstream certification itself had been found in violation of section 337. As stated supra, one of the factors listed in EPROMs to be considered in determining the scope of an exclusion order with respect to downstream products is the identity of the manufacturer of the downstream products (i.e., are the downstream products manufactured by the party found to have committed the unfair act). However, unlike the situation in Hyundai, the certification procedure proposed in this investigation would affect third parties, i.e., parties that have not been found in violation of section 337.

Based on the foregoing the administrative law judge does not recommend a downstream certification procedure.

C. Cease and Desist Orders

Complainants argued that because NEOCO has had at least 100,000 magnets in inventory, a cease and desist order should issue against it. (CPost at 137-138, citing its proposed finding 841). Complainants also argued that, because A.R.E. and Multi-Trend have either failed to respond to the complaint (or amended complaint), or have failed to provide adequate responses to complainants' discovery requests, adverse inferences, concerning their inventory of infringing magnets, should be drawn against A.R.E. and Multi-Trend, pursuant to Commission rule 210.16; that because Harvard did not participate at the hearing, adverse inferences concerning its inventory of infringing magnets should be drawn against Harvard pursuant to Commission rule 210.17; and that in view of said adverse inferences, cease and desist orders should be issued against Harvard, A.R.E. and Multi-Trend. (CPost at 137, 138).

The staff argued that it is unaware of evidence indicating that respondents have commercially significant inventory of accused magnets and therefore is unable to support a cease and desist order against any of the respondents. (SPost at 79).

NEOCO argued that it does not maintain any inventory of product within the United States (NpostR at 22); and that the evidence cited by complainants contains no representations regarding NEOCO's inventory, but rather is a deposition of a representative of H.T.I.E. not NEOCO. (ROCFF 841).

As to any cease and desist orders, 19 U.S.C. § 1337(f) permits the Commission to issue, in lieu of or in addition to an exclusion order, a cease and desist order directing persons found to have violated Section 1337 "to cease and desist from engaging in the unfair methods or acts involved ...." The Commission has ruled that: "In general, cease and desist orders are warranted with respect to domestic respondents that maintain commercially significant U.S. inventories of the infringing product," and domestic respondents who have been defaulted under Commission rule 210.6 are presumed to maintain significant inventories of infringing products in the United States and are likewise subject to cease and desist orders. Certain Agricultural Tractors, Inv. No. 337-TA-380, 44 U.S.P.Q.2d 1385, 1404, n. 124 (Fed. Cir. 1997) (Tractors).

With respect to NEOCO, proposed finding 841 relied on by complainants cites the deposition testimony of Tao (CX-148) and his testimony concerns A.R.E. invoices. While NEOCO sells its magnets to A.R.E. (FF 395), the administrative law judge finds that testimony concerning A.R.E.'s invoices is insufficient to establish that NEOCO has a substantial inventory of infringing magnets. Thus, the testimony reflects that A.R.E. had inventory of infringing magnets. Hence, said testimony is insufficient to establish that NEOCO itself currently has a substantial inventory of infringing magnets. Moreover, NEOCO has actively participated in the hearing and has not been found in default. Also, NEOCO strenuously opposed a cease and desist order in its posthearing submissions. The administrative law judge can find no evidence in the record to support a finding that NEOCO maintains a significant U.S. inventory of infringing magnets.

A.R.E. has been found in default pursuant to Commission Rule 210.16. While Chiang of Multi-Trend in a declaration (See Order No. 60) declared that the amount of product in question involving Multi-Trend is approximately $900.00, Multi-Trend has been held in default pursuant to Commission rule 210.16. In contrast to NEOCO, Multi-Trend did not participate in the hearing and the administrative law judge can find no evidence corroborating

Chiang's declaration that it only dealt with $900.00 worth of accused magnets. While Harvard has not been held in default pursuant to Commission rule 210.16, Harvard did not participate at the hearing nor did it file any posthearing submissions denying the existence of inventory. See Procedural History supra. Thus, the administrative law judge is drawing adverse inferences against Harvard pursuant to Commission rule 210.17.

Based on the foregoing and in view of the Commission opinion in Tractors supra, the administrative law judge recommends cease and desist orders against each of Harvard, A.R.E. and Multi-Trend.

XIII. Bonding

Complainants have requested a bond of 100% during the presidential review period. In support of a bond of 100% complainants argued that because most magnets are "made to order" it is difficult to establish a set price differential between imported magnets and magnets manufactured in the United States; that when the Commission does not have adequate evidence on which to establish a bond rate the bond rate is often set at 100%, citing Certain Neodymium-Iron-Boron Magnets, Magnet Alloys, And Articles Containing The Same, Inv. No. 337-TA-372, Comm'n Op. at 15 (Magnets); and that in view of the uncertainty surrounding the precise price differential between imported and domestic magnets, a bond of 100% is appropriate. (CPost at 138-139).

The staff argued that a bond of 100% was set in Magnets in order to protect the complainant from any injury during the presidential review period; that the circumstances that led to the imposition of a 100% bond in the earlier investigation "still exist;" and that, therefore, a bond of 100% should be imposed in this investigation. (SPost at 80).

NEOCO did not address the issue of bond in its posthearing submissions.

Section 1337(j) provides for the entry of infringing articles upon the payment of a bond during the sixty (60)-day Presidential review period. The bond is to be set to a level sufficient to "protect complainant from any injury" during the Presidential review period. 19 U.S.C. § 1337(j). In Certain Compact Multipurpose Tools, Inv. No. 337-TA-416, Unreviewed Final Initial and Recommended Determinations at 29 (May 27, 1999) (Tools), the Commission held that a bond of 100% is appropriate where a calculation of the level of bond cannot be made based on price differential because of the absence of evidence pertaining to the sales prices of the accused products. See also Magnets at 15.

The administrative law judge finds the evidence in the record inadequate to establish a bond rate. Thus, the administrative law judge recommends a bond of 100%. See Tools and Magnets

ADDITIONAL FINDINGS

I. Parties Including Former Respondents

1. Complainant Magnequench is a corporation incorporated under the laws of Delaware. It has a principal place of business of 6435 Scatterfield Road, Anderson, Indiana 46013. Since 1995 it has manufactured, and continues to manufacture rare-earth magnets and magnetic materials at its facilities in Anderson, Indiana. These magnets and magnetic materials include Magnequench's products "MQP," "MQ1," "MQ2," and "MQ3" which all contain neodymium, iron and boron. (Cox, CX-85 at 1, 2; CX-86; Order No. 390; CX-15, par. 11).

2. Complainant SSMC is a corporation found and existing under the laws of Japan. Its principal place of business at 4-7-19 Kitashama, Chua-Ku, Osaka 541, Japan. SSMC has engaged in licensing activities of rare earth magnets and magnetic material covered by the SSMC patents in issue. For example it has licensed in the United States Hitachi Magnetics Corporation to produce rare earth magnets. (CX-12-14; CX-15 par. 14; Order No. 39).

3. Respondent NEOCO is a business entity in Pennsylvania having a business address at 777 Linden Street, Sharon, Pennsylvania 16146, and/or 3128 Walton Blvd., Suite 197, Rochester Hills, Michigan, 48309. (Order No. 21 at 1).

4. Respondent High End is a Taiwanese company having a business address at No. 14 Industrial 4th Road, Hsinchu Industrial Park, Hsinchu Hsein, Taiwan, Republic of China. (CX-15 at 9, par. 22).

5. Respondent Harvard is a California corporation, having a business address at 470 Nibus Street, Brea, California 92621. (CX-15 at 9, par. 21). Harvard was one of the

original respondents named in the complaint (id.).

6. Respondent Multi-Trend is a California corporation, having a business address at 43288 Christy Street, Fremont, California 94538. (CX-15 at 8, par. 19).

7. Respondent A.R.E. is a business entity in Pennsylvania having a business address at 777 Linden Street and/or 782 Pearl Street, Sharon, Pennsylvania 16146. (Order No. 21, at 1).

8. Respondent Jing Ma, which may also be known as Beijing Jing Ma Technology Co., Beijing Jinci Magnetism Technology Co., Beijing Magnet Technology Co., or Jing Ma RE Material Factory, is a Chinese company having a business address at West Building No. 8 (P.O. Box 718), Chaoyang (or Zhaoyang) District, Beijing 100016, China. (Order No. 21 at 2; Order No. 38 at 11 n. 29).

9. Respondent Xin Huan is a Chinese company having a business address at No. 8 South 3rd Street, Zhong Guan Cun Road, Beijing, China. (Order No. 21 at 2).

10. Former respondent Houghes is a New York corporation, having a business address at 40 Hicks Lane, Great Neck, New York 11023. (CX-15 at 7, par. 17). Houghes imported rare-earth Nd-Fe-B magnets and magnetic materials into the United States from respondent Xin Huan and sells these magnets and magnetic materials to customers in the United States, including former respondent IMI. (Order No. 38 at 5-6; CX-15 at 7, par. 17).

11. Former respondent IMI is an Indiana corporation, having a principal address at 3103 Cascade Drive, Valparaiso, Indiana 46383. (CX-15 at 7, par. 18). IMI purchased rare-earth Nd-Fe-B magnets from former respondent Houghes, which Houghes had imported from respondent Xin Huan in China. IMI subsequently sold such magnets to various entities

within the United States. (Order No. 38 at 6-7; CX-15 at 7, par. 18).

12. Former respondent AUG has a business address at 20807 Tall Forest Drive, Germantown, Maryland 20876. (CX-15 at 8, par. 20).

13. Former respondent CYNNY is a New Jersey corporation having a business address at 5 Highview Court, Montville, New Jersey 07045. (CX-15 at 10, par. 24).

14. Former respondent H.T.I.E. is a company having a business address at 782 Pearl Street, Sharon, Pennsylvania 16146. (CX-15 at 9, par. 23). H.T.I.E. has imported rare-earth Nd-Fe-B magnets or magnetic materials into the United States and sold such magnets or magnetic materials in the United States after importation. (Order No. 38 at 7). In particular, H.T.I.E. has purchased and imported into the United States rare-earth Nd-Fe-B magnets from respondent Jing Ma through foreign trading companies. (Order No. 38 at 11).

II. Experts

15. Complainants' witness Sivaraman Guruswamy was accepted as an expert in the field of material science, metallurgy and metallurgical engineering. (CX-76, Qs. 1-33; CX-57; Guruswamy, Tr. at 246, 250).

16. NEOCO's witness Melvin A. Bohlmann was qualified as an expert in the area of magnets and the science underlying magnets and magnetic materials. (Tr. at 1292, 1293).

17. Complainants' witness Portus M. Wheeler was qualified as an expert in the permanent magnet industry. (Tr. at 922 to 924).

18. Complainants' witness William J. James was accepted as an expert in the area of chemistry, metallurgy, metallurgical compositions including magnetics and magnetic compositions and particularly neodymium-iron-boron type of magnetic compositions, and the

various properties of such compositions and the various processes that are used to prepare such compositions. (Tr. at 1857).

III. Magnequench '395 Patent

19. The '395 patent titled "High Coercivity Rare Earth-Iron Magnets" and which issued on Jan. 29. 1985 is based on Ser. No. 274,070 filed June 16, 1981 and has the named inventor John J. Croat. The '395 patent on its face is assigned to General Motors Corp. (CX-3). The '395 patent was subsequently assigned to Magnequench. (CX-10).

20. The '395 patent relates to substantially amorphous rare earth-iron (Re-Fe) alloys with high room temperature magnetic coercivities and to a reliable method of forming such magnetic alloys from molten precursors. (CX-3, col. 1 lines 5-9).

21. The '395 patent, under the subheading BACKGROUND, discloses that intermetallic compounds of certain rare earth and transition metals (RE-TM) can be made into magnetically aligned permanent magnets with coercivities of several thousand Oersteds; that the compounds are ground into sub-crystal sized particles commensurate with single magnetic domain size, and are then aligned in a magnetic field; and that the particle alignment and consequently the magnetic alignment is fixed into intermetallic compounds by sintering or by dispersing the particles in a resinous binder or low melting metal such as lead (often referred to as the powder metallurgy process of making rare earth-transition metal magnets) which intermetallic compounds develop high intrinsic magnetic coercivities at room temperature. (CX-3, lines 11-24).

22. The '395 patent, under the subheading BACKGROUND, also discloses that the most common intermetallic compounds processable into magnets by the powder metallurgy

method contain substantial amounts of the elements samarium and cobalt, e.g., $SmCo_5$, Sm_2Co_{17} which metals are relatively expensive due to scarcity in the world market and therefore are undesirable components for mass produced magnets; that while lower atomic weight rare earth elements such as cerium, praseodymium and neodymium are more abundant and less expensive than samarium and similarly, iron is preferred over cobalt, it is well known that the light rare earth elements and iron do not form intermetallic phases when homogeneously melted together and allowed to crystallize as they cool; and that attempts to magnetically harden such rare earth-iron alloys by powder metallurgy processing have not been successful. (CX-3, lines 25-40).

23. Objects of the invention of the '395 patent include providing magnetically hard "RE-TM" (rare earth and transition metals) alloys particularly Re-Fe alloys and providing hard magnetic alloys with room temperature coercivities of at least several thousand Oersteds directly from molten earth elements such as Ce, Pr, Nd and the abundant transition metal Fe by a specially adapted quenching process. (CX-3, col. 1 lines 47-64).

24. The '395 patent, with respect to the key to practicing the invention of the '395 patent, discloses, (CX-3, col. 5, lines 27 to 53):

> The key to practicing my invention is to quench a molten rare earth-transition metal alloy, particularly rare earth-iron alloy, at a rate slower than the cooling rate needed to form amorphous, glass-like solids with soft magnetic properties but fast enough to avoid the formation of a crystalline, soft magnetic microstructure. High magnetic coercivity (generally greater than 1,000 Oe) characterizes quenched RE-TM compositions formed in accordance with my method. These hard magnetic properties distinguish my alloys from any like composition previously formed by melt-spinning, simply alloying, or high rate sputtering followed by low temperature annealing. X-ray diffraction

patterns of some of the Nd-Fe and Pr-Fe alloys to contain weak Bragg reflections corresponding to crystalline rare earths (Nd, Pr) and the RE_2Fe_{17} intermetallic phases. Owing to the low magnetic ordering temperatures of these phases (less than 300° K.), however, it is highly unlikely that they could be the magnetically hard component in these melt spun alloys. The coercive force is believed due to an underlying amorphous or very finely crystalline alloy. The preferred $Sm_{0.4}Fe_{0.6}$ and $Tb_{0.4}Fe_{0.6}$ alloys also contain weak Bragg reflections which could be indexed to the $REFe_2$ intermetallic phases. These phases do have relatively high magnetic ordering temperatures (approximately 700° K.) and could account for the coercivity in these alloys.

It also discloses (CX-3, col. 2, lines 51-61):

> Critical to the invention is controlling the quench rate of the molten RE-Fe alloys. Enough atomic ordering should occur upon solidification to achieve high magnetic coercivity. However, a magnetically soft crystalline microstructure should be avoided. While spin melting is a suitable method of quenching molten RE-TM to achieve hard magnetic materials, any other equivalent quenching means such as, e.g., spraying the molten metal onto a cooled substrate would fall within the scope of my invention.

25. The '395 patent contains five examples each of which relate to neodymium or praseodymium. Example I references FIGS. 1 and 2. With respect to those figures, the '395 patent discloses (CX-3, col. 3, lines 6-11):

> FIG. 1 is aschematic view of a spin melting apparatus suitable for use in the practice of the invention; and
>
> FIG. 2 is a plot of substrate surface velocity versus intrinsic coercivity for $Nd_{0.4}$ $Fe_{0.6}$ at 295° K. The parenthetical numbers adjacent the data points are measured ribbon thicknesses.

Example II references FIG. 3 which is a plot of substrate surface velocity versus intrinsic coercivity for three different spun melt neodymium-iron alloys. (CX-3, col. 3, lines 12-15, col. 6, lines 22-40). Example III references FIG. 4 which is a plot of chill substrate surface velocity versus intrinsic magnetic coercivity for spun melt $Nd_{0.4}$ $Fe_{0.6}$ at ejection orifice diameters of 1200, 500 and 250 microns. (CX-3, col. 3, lines 15-18, col. 6, lines 40-62). Example IV references FIG. 5 which is a hystersis curve for $Nd_{0.4}Fe_{0.6}$ taken at 295° C for four different chill substrate speeds. (CX-3, col. 3, lines 19-29, col. 6, lines 65-68, col. 7, lines 1-10). Example V references FIG. 6 which is a plot of substrate surface velocity versus intrinsic coercivity for 5 different alloys of spun melt praseodymium-iron alloys. (CX-3, col. 3, lines 21-24, col. 7, lines 11-22).

26. In issue are independent claims 13, 14, 15, 16, 17 and 18. Claim 13 of the '395 patent reads:

> A permanent magnet alloy having an inherent intrinsic magnetic coercivity of at least 5000 Oersteds at room temperature comprising iron and one or more rare earth elements taken from the group consisting of neodymium and praseodymium

(CX-3, '395 patent, col. 10, lines 1-5).

27. Claim 14 of the '395 patent reads:

> A permanent magnet having an inherent intrinsic magnetic coercivity of at least 5000 Oersteds at room temperature which comprises one or more light rare earth elements taken from the group consisting of neodymium and praseodymium and at least 50 atomic percent iron.

(CX-3, '395 patent, col. 10, lines 6-11).

28. Claim 15 of the '395 patent reads:

> A permanent magnet having an inherent intrinsic magnetic coercivity of at least 5000 Oersteds at room temperature and a magnetic ordering temperature above about 295° K, which comprises one or more rare earth elements taken from the group consisting of neodymium and praseodymium, and at least about 50 atomic percent iron.

(CX-3, '395 patent, col. 10, lines 12-18).

29. Claim 16 of the '395 patent reads:

> A permanent magnet alloy having an inherent intrinsic magnetic coercivity of at least 5000 Oersteds at room temperature and a magnetic ordering temperature above about 295° K, comprising one or more rare earth element constituents taken from the group consisting of neodymium, praseodymium or mischmetals thereof and iron or iron mixed with a small amount of cobalt where the iron comprises at least 50 atomic percent of the alloy

(CX-3, Col. 10, lines 19-27).

30. Claim 17 of the '395 patent reads:

> A permanent magnet containing a magnetic phase based on one or more rare earth elements and iron, which phase has an intrinsic magnetic coercivity of at least 5000 Oersteds at room temperature and a magnetic ordering temperature above about 295° K, the rare earth constituent consisting predominantly of neodymium and/or praseodymium

(CX-3, col. 10, lines 28-34).

31. Claim 18 of the '395 patent reads:

> A permanent magnet based on neodymium and iron, which phase has an intrinsic magnetic coercivity of at least 5,000 Oersteds at room temperature and a magnetic ordering temperature above about 295° K

(CX-3, col. 10, lines 35-38).

IV. Magnequench '058 Patent

32. The '058 patent titled "High Energy Rare Earth-Iron Magnet Alloys" and which issued on July 25, 1989 is based on Ser. No. 414,936 filed Sept. 3 1982 and has the named inventor John J. Croat. The '058 patent on its face is assigned to General Motions Corp. (CX-

1). The '058 patent was subsequently assigned to Magnequench. (CX-10).

33. The '058 patent specifically relates to the addition of small amounts of boron to melted and rapidly quenched rare-earth-iron magnet alloys to increase their room temperature hard magnetic properties, including coercivity, remanent magnetization, and energy product. (CX-1, col. 1, lines 9-12).

34. The '058 patent, under the subheading BACKGROUND, makes reference to Ser. No. 274,070, on which the '395 patent is based. (CX-3). Thus the BACKGROUND states in part. (CX-1, col. 1, lines 15-55, 65-68, col. 2 lines 1-10):

> U.S. Ser. No. 274,070, entitled high Coercivity Rare Earth-Iron Magnets and assigned to the assignee hereof, discloses novel hard magnet compositions and the method of making them. More specifically, it relates to alloying mixtures of one or more transition metals and one or more rare earth elements. The alloys are thereafter quenched from a molten state at a rate such that they solidify with substantially amorphous or extremely fine grained crystalline microstructures (as determined by ordinary X-ray diffraction techniques) and have room temperature intrinsic magnetic coercivities after magnetization of at least about 1,000 Oersteds. The preferred transition metal for the magnet alloys is iron, and the preferred rare earth elements are praseodymium and neodymium. These constituents are preferred because of their relative abundance in nature, low cost, as well as inherently higher magnetic moments.
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> Because the usefulness of a hard magnet is a direct function of its strength, I have looked for a means of increasing the intrinsic coercivity and energy product of these and other substantially amorphous rare earth-transition metal (RE-TM) hard magnet compositions. I have also looked for a way to increase the relative iron content of amorphous rare-earth-iron (RE-Fe) magnet alloys without sacrificing intrinsic coercivity. Higher iron concentration is desirable because of reduced alloy cost and improved magnetic energy product. I have also sought a way of increasing the temperature at which such magnet compositions retain their hard magnet properties.

> Accordingly, it is an object of the invention to provide substantially amorphous or extremely fine grained rare earth-transition metal hard magnet compositions with improved intrinsic magnetic coercivities and energy products, even at elevated temperatures. A more particular object is to add a small amount of the element boron to known, substantially amorphous, magnetically hard rare earth-transition metal compositions to improve their intrinsic coercivities, energy products and increase their Curie temperatures.
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> * * *
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> Yet another object of the invention is to provide a means of increasing the relative iron content of rare earth-iron alloy compositions without untoward loss of intrinsic coercivity. More particularly, it is an object to add an amount of boron to a magnetically hard, amorphous alloy of low atomic weight rare earth elements and iron sufficient to improve and stabilize its inherent intrinsic magnetic coercivity and energy product. Another particular object is to increase the residual magnetism of such high coercivity alloys by increasing their iron content.

35. The '058 patent, under the subheading BRIEF SUMMARY, discloses that in accordance with a preferred practice of the invention, an alloy with hard magnetic properties is formed having the basic formula RE_{1-X} (TM_{1-y} By)x; that in this formula, RE represents one or more rare earth elements taken from the group of elements including scandium and yttrium in group IIIA of the periodic table and the elements from atomic number 57 (lanthanum) through 71 (lutetium); that the preferred rare earth elements are the lower atomic weight members of the lanthanide series, particularly neodymium and praseodymium; that TM is used to symbolize a transition metal taken from the group consisting of iron, nickel and cobalt, iron being preferred for its relatively high magnetic remanence and low cost; that B represents the element boron; that X is the combined atomic fraction of transition metal and boron present in a said composition and generally $0.5 \leq x \leq 0.9$; that Y is the atomic fraction of boron present in

the composition based on the amount of boron and transition metal present, that the preferred range for y is $0.01 \leq y \leq 0.20$; that the incorporation of only a small amount of boron in the compositions was found to substantially increase the coercivity of RE-Fe alloys at temperatures up to 200° C. or greater, particularly those alloys having high iron concentrations; that in fact, the alloy $Nd_{0.2}(Fe_{0.95}B_{0.05})_{0.8}$ exhibited an intrinsic magnetic room temperature coercivity exceeding about 20 kiloOersteds, substantially comparable to the hard magnetic characteristics of much more expensive $SmCo_5$ magnets; and that the boron addition also substantially improved the energy product of the alloy and increased its Curie temperature. (CX-1, lines 11-41).

36. The '058 patent, under the subheading BRIEF SUMMARY makes another reference to Ser. No. 274,070, on which the '395 is based. Thus it states (CX-1, col. 2, lines 42-62):

> The subject permanent magnet alloys were made by mixing suitable weight portions of elemental forms of the rare earths, transition metals and boron together. These mixtures were arc melted to form alloy ingots. The alloy was in turn remelted in a quartz crucible and extruded through a small nozzle onto a rotating chill surface. This produced thin ribbons of alloy. The process is generally referred to in the art as "melt spinning" and is fully described in U.S. Ser. No. 274,070 [the '395 patent]. The rotational velocity of the quench wheel was adjusted so that the alloy cooled at a rate at which an alloy with a substantially amorphous to an extremely fine grained microstructure formed. The alloys claimed herein all exhibited high intrinsic magnetic coercivities. Moreover, the addition of boron in suitable amounts was found to increase the intrinsic coercivity, magnetic remanence and energy product of all melt-spun magnetically hard RE-iron alloys examined. Moreover, the Curie temperature was substantially elevated.

37. The '058 patent, under the subheading DETAILED DESCRIPTION and the

further sub-heading "Melt Spinning," discloses (CX-1, col. 5, lines 17-31):

> While melt spinning is a preferred method of making the subject boron enhanced RE-TM magnet materials, other comparable methods may be employed. The critical element of the melt spinning process is the controlled quenching of the molten alloy to produce a substantially amorphous to extremely finely crystalline microstructure. The terms "substantially amorphous" and "finely crystalline" herein refer to solids having x-ray diffraction patterns which do not indicate the presence of fully crystalline phases. X-ray patterns of the subject RE-TM-B alloys have ranged from substantially flat to those exhibiting definite peaks of low intensity which would not be indicative of the presence of a uniform, totally crystalline alloy. Any other process accomplishing a like controlled cooling of the alloys from their melts could be used.

38. The '058 patent contains twenty-one (21) examples, and twenty-one (21) Figures, each of which relates to neodymium or praseodymium, iron boron containing alloys (CX-1). Example 19 and Figure 19 shows typical demagnetization curves for various permanent magnet materials with values for their maximum energy products. While $SmCo_5$ showed better room temperature magnetic properties than the "subject neodymium-iron-boron composition", bonded $SmCo_5$ powder magnets were substantially weaker. (CX-1, col. 10).

39. In issue are independent claim 1, 4, 5, 8, 9 and 11. Each of claims 1, 4 and 8 require the presence of neodymium, praseodymium or mixtures thereof, iron and boron. (CX-1, col. 11, 12, 13).

40. Each of claims 5, 9 and 11 require the presence of neodymium or praseodymium, iron and boron. (CX-1, col. 11, 12, 13).

41. Claim 1 of the '058 patent reads as follows:

> A magnetically hard alloy composition comprised of at least about 10 to about 40 atomic percent neodymium, praseodymium

or mixtures thereof; at least about 50 to about 90 atomic percent iron and from about 0.5 to 10 atomic percent boron.

(CX-1, col. 11, lines 49-53).

42. Claim 4 of the '058 patent reads as follows:

A magnetically hard alloy composition comprising one or more rare earth elements including at least about 10 to about 40 atomic percent of one or more rare earth elements taken from the group consisting of neodymium, praseodymium or mixtures thereof; at least about 50 to about 90 atomic percent iron, and at least about 0.5 atomic percent boron, said atomic percent being based on the total alloy composition and said alloy having an intrinsic magnetic coercivity of at least about 5,000 Oersteds at room temperature.

(CX-1, col. 12, lines 8-17).

43. Claim 5 of the '058 patent reads as follows:

A magnetically hard alloy composition having a coercivity of at least about 1,000 Oersteds at room temperature and consisting essentially of one or more earth [sic] elements including at least about 10 to about 40 atomic percent neodymium and/or praseodymium based on the total composition; at least about 0.5 atomic percent boron; up to about 90 atomic percent of one or more transition metal elements taken from the group consisting of iron, nickel, and cobalt where said iron comprises at least about 50 atomic percent of the total alloy composition; the presence of the boron in the alloy increasing its Curie temperature with respect to a like alloy containing substantially no boron.

(CX-1, col. 12, lines 18-30).

44. Claim 8 of the '058 patent reads as follows:

A hard magnet consisting essentially of an alloy having the constituent formula

RE_{1-x}(F[sic]1-yB$)_x$

where RE is one or more rare earth elements taken from the group consisting of praseodymium, neodymium or mixtures thereof; Fe is iron; and B is the element boron; wherein said formula x is the combined atomic fraction of said iron and boron present in said alloy where x is about 0.5 to about 0.9 and x times (1-y) is greater than or equal to 0.5; and y is the atomic fraction boron based on the amount of iron and boron present in said alloy where y is about 0.01 to about 0.1.

(CX-1, col. 12, line 60 - col. 13, line 5).

45. Claim 9 of the '058 patent reads as follows:

> A magnetically hard alloy composition having a coercivity of at least about 1,000 Oersteds at room temperature and comprising from about 10 to about 40 atomic percent of one or more rare earth elements taken from the group consisting of praseodymium, neodymium, samarium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and misch metals thereof wherein the neodymium and/or praseodymium comprise at least about 10 atomic percent of the total composition; one or more transition metal elements including at least about 50 to 90 atomic percent iron based on the total composition; and at least about 0.5 atomic percent boron based on the total composition.

(CX-1, col. 13, lines 6-18).

46. Claim 11 of the '058 patent reads as follows:

> A magnetically hard alloy composition comprised of one or more rare earth elements including at least about 10 to about 40 atomic percent based on the alloy composition of neodymium and/or praseodymium; one or more transition metal elements including at least about 50 to about 90 atomic percent iron based on the alloy composition, and greater than about 0.5 atomic percent of the alloy composition boron, said alloy having a magnetic coercivity of at least about 5,000 Oersteds and a remanance of at least about 4,000 Gauss at room temperature.

(CX-1, col. 14, lines 11-21).

V. Magnequench '931 Patent

47. The '931 patent titled "High Energy Product Rare Earth-Iron Magnet Alloys"

and which issued on Feb. 7, 1989 is based on Ser. No. 544,728 filed Oct. 26, 1983 and has the named inventor John J. Croat. The '931 patent on its face is assigned to General Motors Corp. (CX-2). The '931 patent was subsequently assigned to Magnequench. (CX-10).

48. A basis of the '931 patent is the '058 patent. Thus the '931 patent discloses that Ser. No. 544, 728, in which the '931 patent is based, is a continuation-in-part of U.S. Ser. No. 508,266 filed on June 24, 1983, which Ser. No. 508,266 is a continuation-in-part of U.S. Ser. No. 414,936 filed on Sept. 3, 1982 and which Ser. No. 414,936 is the basis of the '058 patent. (CX-2, col. 1, lines 5-8; CX-1).

49. A comparison of the '931 patent and the '058 patent shows that, while the '058 patent contains 21 examples and 21 figures, the '931 patent contains 33 examples and 52 figures and also that the first 21 examples of each patent are not identical. (CX-1, CX-2). Each of the examples of the '931 patent relate to neodymium or praseodymium, iron and boron compositions. (CX-2).

50. The invention of the '931 patent relates to permanent magnet alloys of rare earth elements, transition metal elements and boron. (CX-2, col. 1, lines 9-10).

51. Under the subheading BACKGROUND, the '931 patent makes reference to the '395 patent. Thus the '931 patent discloses (CX-2, col. 1, lines 14-31):

> U.S. Pat. No. 4,496,395 [in issue], entitled 'High Coercivity Rare Earth-Iron Magnets", assigned to the assignee hereof, discloses novel magnetically hard compositions and the method of making them. More specifically, it relates to alloying mixtures of one or more transition metals and one or more rare-earth elements. The alloys are quenched from a molten state at a carefully controlled rate such that they solidify with extremely fine grained crystalline microstructures as determinable by X-ray diffraction of powdered samples. The alloys have room

temperature intrinsic magnetic coercivities after saturation magnetization of at least about 1,000 Oersteds. The preferred transition metal for the magnet alloys is iron, and the preferred rare earth elements are praseodymium and neodymium. Among the reasons why these constituents are preferred are their relative abundance in nature, low cost and inherently higher magnetic moments.

52. The '931 patent discloses the following objects of the invention disclosed in said patent (CX-2, col. 1, lines 32-68, col. 2, lines 1-7):

> I have now discovered a new family of magnets that have markedly improved properties compared with my earlier discovery. It is an object of the subject invention to provide novel magnetically hard compositions based on rare earth elements and iron with extremely fine grained crystal structures having very high magnetic remanence and energy products and Curie temperatures well above room temperature. Another object is to create a stable, finely crystalline, magnetically hard, rare earth element and iron containing phase in melted and rapidly quenched alloys so that strong permanent magnets can be reliably and economically produced.
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> A more specific object is to make magnetically hard alloys by melting and rapidly quenching mixtures of one or more rare earth elements, one or more transition metal elements and the element boron. Such alloys exhibit higher intrinsic coercivities and energy products than boron-free alloys. A more specific object is to make such high strength magnet alloys from iron, boron and lower atomic weight rare earth elements, particularly neodymium and praseodymium. Another object is to make these magnetically hard alloys by melt spinning or a comparable rapid solidification process.
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> Yet another object of the invention is to provide a novel, stable, rare earth-iron-boron, intermetallic, very finely crystalline, magnetic phase. A more particular object is to control the formation of such phase so that the crystalline size appears to be commensurate with optimum single magnetic domain size either by a direct quench or overquench and subsequent heat treatment. Another particular object is to either directly or indirectly create such optimum domain size crystallites in a melt spun or otherwise

rapidly quenched RE-Fe-B alloy, particularly a neodymium or praseodymium-iron boron alloy.

It is a further object to provide a suitable amount of boron in a mixture of low atomic weight rare earth elements and iron to promote the formation of a stable, very finely crystalline, intermetallic phase having high magnetic remanence and energy product. Another particular object is to provide the constituent metallic elements in suitable proportions to form these new intermetallic phases and then process the alloys to optimize the resultant hard magnetic properties.

53. In issue are independent claims 1, 2, 3, 10, 14, 16, 18, 19 and 20 and dependent claims 4, 5, 6 and 15. Claim 1 of the '931 patent reads as follows:

A permanent magnet in which the predominant phase is $(RE_{1-a}RE'_{a})_2(Fe_{1-b}TM_b)_{14}B_1$ where RE is neodymium and/or praseodymium and comprises at least about 6 atomic percent of the magnet; RE' is one or more rare-earth elements taken from the group consisting of yttrium, lanthanum, cerium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium and lutetium and where a is from 0 to about 0.4 and RE and RE' together comprise up to about 40 atomic percent of the magnet; TM is one or more transition metal elements taken from the group consisting of cobalt, nickel, manganese, chromium and copper where b is from 0 to about 0.4 and Fe comprises at least about 40 atomic percent, and Fe and TM, together comprise up to about 90 atomic percent of the magnet; and B comprises at least from about 0.5 to about 10 atomic percent of the magnet, the magnet having intrinsic magnetic coercivity of at least 1,000 Oersteds.

(CX-2, col. 25, lines 51-68).

54. Claim 2 of the '931 patent reads as follows:

A permanent magnet having an energy product at magnetic saturation of at least about 5 megaGaussOersteds comprising at least about 10 to about 40 atomic percent of one or more rare earth elements at least about 6 percent of the magnet consisting of neodymium and/or praseodymium; at least about 0.5 to about 10

> atomic percent boron; and at least about 50 to 90 atomic percent total transition metal elements taken from the group consisting of iron and mixtures of iron and cobalt where the amount of said cobalt in said mixture is less than about 40 percent of the iron and wherein the predominant phase is $RE_2TM_{14}B_1$.

(CX-2, col. 26, lines 1-12).

55. Claim 3 of the '931 patent reads as follows:

> A magnetically hard alloy composition comprising at least about 10 to about 40 atomic percent of one or more rare earth elements and wherein at least about 60 atomic percent of the total said rare earth elements is taken from the group consisting of praseodymium and neodymium; at least about 0.5 to about 10 atomic percent boron; and up to about 90 total atomic percent of one or more transition metal elements including iron in an amount of at least about 40 atomic percent of the alloy and wherein the predominant phase is $RE_2TM_{14}B_1$.

(CX-2, col. 26, lines 13-23).

56. Claim 4 of the '931 patent reads as follows:

> The composition of claim 3 characterized by the inclusion of a heavy rare earth element to increase magnetic coercivity.

(CX-2, col. 26, lines 24-26).

57. Claim 5 of the '931 patent reads as follows:

> The composition of claim 3 characterized by an intrinsic magnetic coercivity of at least about 5 kiloOersteds and an energy product at magnetic saturation of at least about 10 megaGaussOersteds.

(CX-2, col. 26, lines 27-30).

58. Claim 6 of the '931 patent reads as follows:

> The composition of claim 3 characterized by a magnetic remanance at saturation of at least about 7 kiloGauss.

(CX-2, col. 26, lines 31-33).

59. Claim 10 of the '931 patent reads as follows:

> A permanent magnet having a coercivity of at least about 1,000 Oersteds at room temperature and which comprises about 10-40 atomic percent of one or more rare earth elements including at least about 6 atomic percent neodymium and/or praseodymium, at least about 0.5 to about 10 atomic percent boron, from zero to less than about 20 total atomic percent based on iron in the alloy of one or more additive metals taken from the group consisting of titanium, nickel, chromium, zirconium and manganese, and up to about 90 atomic percent total of one or more transition metals including at least about 40 atomic percent iron and in which magnet the predominant magnetically hard constituent is the tetragonal crystal phase $RE_2TM_{14}B_1$.

(CX-2, col. 26, lines 51-64).

60. Claim 14 of the '931 patent reads as follows:

> A $RE_2TM_{14}B_1$ type permanent magnet alloy comprising at least about 10 to about 40 atomic percent neodymium and/or praseodymium, at least about 50 to about 90 atomic percent iron, at least about 0.5 to about 10 atomic percent boron, and up to about 20 atomic percent of one or more heavy rare earth elements based on the neodymium and praseodymium, the magnetic coercivity of said alloy being at least about 5,000 Oersteds at room temperature.

(CX-2, col. 27, lines 30-38).

61. Claim 15 of the '931 patent reads as follows:

> The magnet alloy of claim 14 where the heavy rare earth element is terbium and/or dysprosium.

(CX-2, col. 27, lines 39-40).

62. Claim 16 of the '931 patent reads as follows:

> A permanent magnet composition comprised predominantly of the tetragonal crystal phase $RE_2TM_{14}B_1$ where RE is one or more

rare earth elements and TM is one or more transition metal elements and where said composition comprises at least about 6 atomic percent Nd and/or Pr and up to about 40 atomic percent rare earths, at least about 0.5 to about 10 atomic percent boron and at least about 50 atomic percent Fe and up to about 90 atomic percent total transition metals including Fe, said composition having an intrinsic magnetic coercivity of at least about 1,000 Oersteds.

(CX-2, col. 27, line 41 - col. 28, line 2).

63. Claim 18 of the '931 patent reads as follows:

> A permanent magnet composition in which the predominant phase is $RE_2Fe_{1-x}Co_{x14}B_1$ where RE is one or more rare earth elements and x is from about zero to 0.4, and where said composition comprises at least about 6 atomic percent Nd and/or Pr and from about 10-40 percent total rare earths, at least about 0.5 to about 10 atomic percent boron and at least about 50 atomic percent Fe and from about 50 to 90 percent total transition metals including iron said composition having an intrinsic magnetic coercivity of at least about 1,000 Oersteds.

(CX-2, col. 28, lines 15-25).

64. Claim 19 of the '931 patent reads as follows:

> A permanent magnet alloy in which the predominant phase is $RE_2(Fe_{1-x}TM_x)_{14}B_1$ where $x < 0.4$ and which phase has a tetragonal crystal structure where RE is one or more rare earth elements, TM is one or more transition metal elements and wherein the crystallographic c-axis is the preferred axis of magnetization and has a length of about 12.2 angstroms and the a-axis has a length of about 8.78 angstroms, and said alloy comprises at least about 6 atomic percent Nd and/or Pr and up to about 40 atomic percent rare earth elements, at least about 40 atomic percent Fe, and up to about 90 atomic percent total transition metals including Fe and at least about 0.5 to about 10 atomic percent boron.

(CX-2, col. 28, lines 26-38).

65. Claim 20 of the '931 patent reads as follows:

> A permanent magnet alloy in which the predominant phase is $Re_2Fe_{14-x}TM_xB_1$ which has a tetragonal crystal structure where RE is one or more rare earth elements, TM is one or more transition metal elements and wherein the crystallographic c-axis is the preferred axis of magnetization, and which alloy comprises at least about 6 atomic percent Nd and/or Pr up to about 40 atomic percent rare earth elements, at least about 40 atomic percent Fe and up to about 90 atomic percent total transition metal elements including Fe, and at least about 0.5 to about 10 atomic percent boron.

(CX-2, col. 28, lines 39-49).

VI. SSMC '368 Patent

66. The '368 patent titled "Magnetic Materials And Permanent Magnets" and which issued on Dec. 20, 1988 is based on Ser. No. 516,841, filed July 25, 1983 and has the named inventors Masato Sagawa, Satsu Fugjmura and Yutaka Matsuura. The '368 patent is assigned to Sumitomo Special Metals, Co., Ltd. (CX-5, CX-13).

67. The '368 patent recites several priority applications the earliest of which is Japanese 57-145072 (8/21/82). (CX-5).

68. The '368 patent relates to improvements in the temperature dependency of the magnetic properties of magnetic materials and permanent magnets based on Fe-B-R systems wherein R denotes rare earth elements inclusive of yttrium. (CX-5, col. 1, lines 6-10).

69. The '368 patent, under the subheading BACKGROUND OF THE INVENTION states in part (CX-5, col. lines 30-43):

> Advance in electronics has caused high integration and miniaturization of electric components. However, the magnetic circuits incorporated therein with alnico or hard ferrite increase inevitably in weight and volume, compared with other components. On the contrary, the SmCo base magnets meet a demand for miniaturization and high efficiency of electric circuits

due to their high Br and Hc. However, samarium is rare natural resource, while cobalt should be included 50-60 wt % therein, and is also distributed at limited areas so that its supply is unstable.

Thus, it is desired to develop novel permanent magnet materials free from these drawbacks.

70. The '368 patent, under the subheading BACKGROUND OF THE INVENTION, makes reference to specific prior art. Thus it states (CX-5, col. 1, lines 42-67, col. 2, lines 1-12):

> If it could be possible to use, as the main component for the rare earth elements light rare earth elements that occur abundantly in ores without employing much cobalt, the rare earth magnets could be used abundantly and with less expense in a wider range. In an effort made to obtain such permanent magnet materials, R-Fe_2 base compounds, wherein R is at least one of rare earth metals, have been investigated. A. E. Clark has discovered that sputtered amorphous $TbFe_2$ has an energy product of 29.5 MGOe at 4.2° K., and shows a coercive force Hc=3.4 kOe and a maximum energy product (BH)max =7 MGOe at room temperature upon heat-treatment at 300°-500° C. Reportedly, similar investigations on $SmFe_2$ indicated that 9.2 MGOe was reached at 77° K. However, these materials are all obtained by sputtering in the form of thin films that cannot be generally used as magnets, e.g., speakers or motors. It has further been reported that melt-quenched ribbons of PrFe base alloys show a coercive force Hc of as high as 2.8 kOe.
>
> In addition, Koon et al discovered that, with melt-quenched amorphous ribbons of $(Fe_{0.82}B_{0.18})_{0.9}\ Tb_{0.05}La_{0.05}$, Hc of 9 kOe was reached upon annealing at 627° C. (Br=5 kG). However, (BH)max is then low due to the unsatisfactory loop squareness of magnetization curves (N.C. Koon et al, Appl. Phys. Lett 39 (10), 1981, pp. 840-842).
>
> Moreover, L. Kabacoff et al reported that among melt-quenched ribbons of $(Fe_{0.8}B_{0.2})1\text{-}_xPr_x$ (x=0-0.03 atomic ratio), certain ones of the Fe-Pr binary system show Hc on the kilo oersted order at room temperature.

> These melt-quenched ribbons or sputtered thin films are not any practical permanent magnets (bodies) that can be used as such. It would be practically impossible to obtain practical permanent magnets from these ribbons or thin films.

71. The '368 patent, under the subheading BACKGROUND OF THE INVENTION comments on the deficiency of the prior art as follows (CX-5, col. 2, lines 12-26):

> That is to say, no bulk permanent magnet bodies of any desired shape and size are obtainable from the conventional Fe-B-R base melt-quenched ribbons or R-Fe base sputtered thin films. Due to the unsatisfactory loop squareness (or rectangularity) of the demagnetization curves, the Fe-B-R base ribbons heretofore reported are not taken as the practical permanent magnet materials comparable with the conventional, ordinary magnets. Since both the sputtered thin films and the melt-quenched ribbons are magnetically isotropic by nature, it is indeed almost impossible to obtain therefrom magnetically anistropic (hereinbelow referred to "anisotropic") permanent magnets for the practical purpose comparable to the conventional hard ferrite or SmCo magnets.

72. The '368 patent, under the subheading SUMMARY OF THE DISCLOSURE, sets forth the following specific objects of the invention of the '368 patent (CX-5, col. 2, lines 29-54):

> As essential object of the present invention is to provide novel magnetic materials and permanent magnets based on the fundamental composition of Fe-B-R having an improved temperature dependency of tha [sic] magnetic properties.
>
> Another object of the present inventions is to provide novel practical permanent magnets and magnetic materials which do not share any disadvantages of the prior art magnetic materials hereinabove mentioned.
>
> A further object of the present invention is to provide novel magnetic materials and permanent magnets having good temperature dependency and magnetic properties at room or elevated temperatures.

> A still further object of the present invention is to provide novel magnetic materials and permanent magnets which can be formed into any desired shape and practical size.
>
> A still further object of the present invention is to provide novel permanent magnets having magnets anisotropy and excelling in both magnetic properties and mechanical strength.
>
> A still further object of the present invention is to provide novel magnetic materials and permanent magnets in which as R use can effectively be made of rare earth element occurring abundantly in nature.

73. The magnetic materials and permanent magnets, according to the invention of the '368 patent, are essentially formed of alloys comprising novel intermetallic compounds, and are crystalline, said intermetallic compounds being characterized at least by new Curie points. (CX-5, col. 2, lines 576-61).

74. According to the first aspect of the invention of the '368 patent (CX-5, col. 2, lines 66-68, col. 3, lines 1-2):

> ... there is provided a magnetic material comprising Fe, B, R (at least one of the rare earth elements including Y) and Co, and having its major phase formed of Fe-Co-B-R (or (Fe, Co)-B-R) type compound that is of the substantially tetragonal system crystal structure.

Therein the '368 patent describes the 2nd and 10th aspects of the invention as follows (col. 3 lines 3 to 49):

> According to the second aspect of the present invention, there is provided a sintered magnetic material having its major phase formed of a compound consisting especially of, in atomic ratio, 8 to 30% of R (wherein R represents at least one of rare earth element including Y), 2 to 28% of B, no more than 50% of Co (except that the amount of Co is not zero) and the balance being Fe and impurities.

According to the third aspect of the present invention, there is provided a sintered magnetic material having a composition similar to that of the aforesaid sintered magnetic material, wherein the major phase is formed of an Fe-Co-B-R type compound that is of the substantially tetragonal system.

According to the fourth aspect of the present invention; there is provided a sintered permanent magnet (an Fe-Co-B-r base permanent magnet) consisting essentially of, in atomic ratio, 8 to 30% of R (at least one of rare earth element including Y), 2 to 28% of B, no more than 50% of Co (except that the amount of Co is not zero) and the balance being Fe and impurities. This magnet is anisotropic.

According to the fifth aspect of the present invention, there is provided a sintered anisotropic permanent magnet having a composition similar to that of the fourth permanent magnet, wherein the major phase is formed by an Fe-Co-B-R type compound that is of the substantially tetragonal system crystal structure.

Fe-Co-B-B base magnetic materials according to the 6^{th} to the 8^{th} aspects of the present invention are obtained by adding to the first-third magnetic materials the following additional elements M, provided, however, that the additional elements M shall individually be added in amounts less that the values as specified below, and that, when two or more elements M are added, the total amount thereof shall be less that the upper limit of the element that is the largest, among the elements actually added (For instance, Ti, V and Nb are added, the sum of these must be no more that 12.5% in all): 4.5% Ti, 8.0% Ni, 5.0% Bi, 9.5% V, 12.5% Nb, 10.5% Ta, 8.5% Cr, 9.5% Mo, 9.5% W, 8.0% Mn, 9.5% Al, 2.5% Sb, 7.0% Ge, 3.5% Sn, 5.5% Zr, and 5.5% Hf.

Fe-B-R-Co base permanent magnets according to the 9^{th} to and 10^{th} aspects of the present invention are obtained by adding respectively to the 4^{th} and 5^{th} permanent magnets the aforesaid additional elements M on the same condition.

75. The '368 patent contains Figures 1 thru 14, 15A, 156B and 16. Each of Figures 1 thru 14 and 16 relate to cobalt containing materials. FIG. 15 is a flow chart of the

experimental procedures of powder X-ray analysis and demagnetization curve measurements. (CX-5, CX-5, col. 4, lines 55-57).

76. Each of independent claims 2, 3, 15 and 16, and dependent claims 4, 5, 6, 8, 9, 10, 17, 18, 19, 21, 23, 24, 29, 30, 31, 37 and 38 in issue requires the presence of cobalt. (CX-5, cols. 25-28).

77. Claim 2 of the '368 patent reads as follows:

> A sintered anisotropic permanent magnet having a maximum energy product of at least 10 MGOe and consisting essentially of, by atomic percent, 12-20 percent R wherein R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and Y and wherein at least 50% of R consists of Nd and/or Pr, 5-18 percent B and the balance being at least 62 percent Fe, in which Co is substituted for Fe in an amount greater than zero and not exceeding 25 percent of the magnet and said permanent magnet has a higher Curie temperature than a corresponding ferromagnetic Fe-B-R base compound containing no Co.

(CX-5, col. 24, lines 40-53).

78. Claim 3 of the '368 patent reads as follows:

> A sintered anisotropic permanent magnet [sic] having a mean crystal grain size of at least about 1 micron and consisting essentially of, by atomic percent 12-20 percent R wherein R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and Y and wherein at least 50% of R consists of Nd and/or Pr, 5-18 percent B and the balance being at least percent Fe, in which Co is substituted for Fe in an amount greater than zero and not exceeding 25 percent of the magnet and at least 50 vol. % of the entire magnet is occupied by a ferromagnetic compound of an (Fe,Co)-B-R type tetragonal crystal structure which has a higher Curie temperature than a corresponding ferromagnetic Fe-B-R base compound containing no Co, the magnet having a maximum energy product of at least 10 MGOe.

(CX-5, col. 24, lines 53-68).

79. Claim 4 of the '368 patent reads as follows:

> A permanent magnet as defined in claim 3, which contains no less than 1 vol. % of nonmagnetic phases.

(CX-5, col. 25, lines 1-2).

80. Claim 5 of the '368 patent reads as follows:

> A permanent magnet as defined in claim 2 or 3 in which the mean crystal grain size is 1 to 100 microns.

(CX-5, col. 25, lines 3-4).

81. Claim 6 of the '368 patent reads as follows:

> A permanent magnet as defined in claim 5, in which the mean crystal grain size is in the range of form 1.5 to 50 microns.

(CX-5, col. 25, lines 5-6).

82. Claim 8 of the '368 patent reads as follows:

> A permanent magnet as defined in claim 2 or 3, in which Sm does not exceed 3 atomic percent in the entire magnet.

(CX-5, col. 25, lines 9-11).

83. Claim 9 of the '368 patent reads as follows:

> A permanent magnet as defined in claim 2 or 3, in which R is about 15 atomic percent, and B is about 8 percent.

(CX-5, col. 25, lines 12-14).

84. Claim 10 of the '368 patent reads as follows:

> A permanent magnet as defined in claim 2 or 3, in which the maximum energy product is at least 20 MGOe.

(CX-5, col. 25, lines 15-17).

85. Claim 15 of the '368 patent reads as follows:

> A sintered anisotropic permanent magnet having a maximum energy product of at least 10 MGOe and consisting essentially of, by atomic percent, 12-20 percent R wherein R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and wherein at least 50% of R consists of Nd and/or Pr, 5-18 percent B, at least one additional element M selected from the group given below in the amounts of no more than the atomic percentages specified below, wherein the sum of M is no more than the maximum value of any one of the values specified below for M actually added and the balance being at least 62 percent Fe wherein Co is substituted for Fe in an amount greater than zero and up to 25 percent of the magnet: 3.3% Ti, 4.5% Ni, 5.0% Bi, 6.6%V, 10.0% Nb, 8.4% Ta, 5.6% Cr, 6.2% Mo, 5.9% W, 3.5% Mn,6.4% Al, 1.4% Sb, 4.5% Ge, 1.8% Sn, 3.7% Zr, and 3.7% Hf; said permanent magnet having a higher Curie temperature than a corresponding ferromagnetic Fe-B-R-M base composition containing no Co, and having a maximum energy product of at least 10 MGOe.

(CX-45, col. 25 line 54 - col. 26, line 7).

86. Claim 16 of the '368 patent reads as follows:

> A sintered anisotropic permanent magnet having a mean crystal grain size of at least about 1 micron and consisting essentially of, by atomic percent, 12-20 percent R wherein R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and where in at least 50% of R consists of Nd and/or Pr, 5-18 percent B, at least one additional element M selected from the group given below in the amounts no more than the atomic percentages specified below, wherein the sum of M is no more than the maximum value of any one of the values specified below for M actually added and the balance being at least 56 percent Fe: 3.3% Ti, 4.5% Ni, 5.0% Bi, 6.6%V, 10.0% Nb, 8.4% Ta, 5.6% Cr, 6.2% Mo, 5.9% W, 3.5% Mn,6.4% Al, 1.4% Sb, 4.5% Ge, 1.8% Sn, 3.7% Zr, and 3.7% Hf, in which a crystal phase of a ferromagnetic compound having a (Fe,Co)-B-R type tetragonal crystal structure occupies at least 50 vol. % of the entire magnet and which has a maximum energy product of at least 10 MGOe

> and a higher Curie temperature than a corresponding ferromagnetic Fe-B-R-M base composition containing no Co.

(CX-5, col. 26, lines 8-33).

87. Claim 17 of the '368 patent reads as follows:

> A permanent magnet as defined in claim 16, which contains no less than 1 vol. % of nonmagnetic phases.

(CX-5, col. 26, lines 34-36).

88. Claim 18 of the '368 patent reads as follows:

> A permanent magnet as defined in claim 15 or 16, in which the mean crystal grain size is in the range of from 1 to 100 microns.

(CX-5, col. 26, lines 37-38).

89. Claim 19 of the '368 patent reads as follows:

> A permanent magnet as defined in claim 18, in which the mean crystal grain size is in the range of from 1.5 to 50 microns.

(CX-5, col. 26, lines 39-40).

90. Claim 21 of the '368 patent reads as follows:

> A permanent magnet as defined in claim 13 or 14, in which Sm is no more than 3 atomic percent in the entire magnet.

(CX-5, col. 26, lines 43-45).

91. Claim 23 of the '368 patent reads as follows:

> A permanent magnet as defined in claim 15 or 16, in which R is about 15 atomic percent, and B is about 8 atomic percent.

(CX-5, col. 26, lines 49-51).

92. Claim 24 of the '368 patent reads as follows:

> A permanent magnet as define in claim 15 or 16, in which the

maximum energy product is at least 20 MGOe.

(CX-5, col. 26, lines 52-54).

93. Claim 29 of the '368 patent reads as follows:

> A sintered anisotropic permanent magnet as defined in claim 3 or 16 wherein said (Fe,Co)-B-R type tetragonal crystal structure has the lattice constants a_0 of about 8.8 angstroms and c_0 of about 12 angstroms.

(CX-5, col. 26, line 67, col. 27, line 2).

94. Claim 30 of the '368 patent reads as follows:

> A permanent magnet as defined in claim 15 or 16 wherein said additional element(s) M is at least one selected from the group consisting of V, Nb, Mo, W and Al.

(CX-5, col. 27, lines 3-5).

95. Claim 31 of the '368 patent reads as follows:

> A magnet as defined in claim 31 [sic], wherein said additional element[s] M is contained no more than the amount by atomic percent as specified below: 3.5% V, 6.4% Nb, 4.1% Mo, 3.9% W, and 3.8% Al; wherein the sum of M does not exceed the maximum value of any one of the values specified above for M actually added.

(CX-5, col. 27, lines 6-11).

96. Claim 37 of the '368 patent reads as follows:

> A sintered anisotropic permanent magnet as defined in claim 2, 3, 15 or 16, wherein R is Nd.

(CX-5, col. 28, lines 30-31).

97. Claim 38 of the '368 patent reads as follows:

> A sintered anisotropic permanent magnet as defined in claim 2, 3, 15 or 16, in which Co is present in at least 1 atomic percent.

(CX-5, col. 28, lines 32-34).

98. The investigation also includes claims 28 and 35. Claim 28 is dependent on claims 1 or 13 and claim 35 is dependent on claim 34 which is dependent on claims 1, 13, 32 or 33. Claims 1, 13, 28, 32, 33, 34 and 35 read:

> 1. An anisotropic magnetic material having a mean crystal grain size of at least about 1 micron and an intrinsic coercivity of at least 1 kOe, and having a maximum energy product of at least 10 MGOe upon sintering, said material consisting essentially of, by atomic percent, 12-20 percent R wherein R is at least one element selected from the group consisting essentially of, by atomic percent, 12-20 percent R wherein R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and Y and wherein at least 50% of R consists of Nd and/or Pr, 5-18 percent B, and the balance being at least 62 percent Fe, in which Co is substituted for Fe in an amount greater than zero and not exceeding 25 percent of the material, at least 50 vol % of the entire material is occupied by a ferromagnetic compound having an (Fe, Co)-B-R type tetragonal crystal structure and a higher Curie temperature than a corresponding ferro-magnetic Fe-B-R base compound containing no Co.

> 13. An anisotropic magnetic material having a mean crystal grain size of at least about 1 micron and an intrinsic coercivity of at least 1 kOe, and having a maximum energy product of at least 10 MGOe upon sintering, said material consisting essentially of, by atomic percent, 12-20 percent R wherein R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and Y and wherein at least 50% of R consists of Nd and/or Pr, 5-18 percent B, at least one additional element M selected from the group given below in the amounts of no more than the atomic percentages specified below wherein when more than one element comprises M, the sum of M is no more than the maximum value of any one of the values specified below for M actually added and the balance being at least 62 percent Fe, in which Co is substituted for Fe in an amount greater than zero and up to 25 percent of the material and a crystal phrase of a ferromagnetic compound having an (Fe,

Co)-B-R type tetragonal crystal structure occupies at least 50 vol% of the entire material: 3.4% Ti, 6.5% Ni, 5.0% Bi, 6.8% V, 9.6% Nb, 8.3% Ta, 5.4% Cr, 6.1% Mo, 6.0% W, 6.0% Mn, 6.3% Al, 1.3% Sb, 4.2% Ge, 2.0% Sn, 4.2% Zr, and 4.2% Hf; and which has a higher Curie Temperature than a corresponding ferromagnetic Fe-B-R-M base composition containing no Co and having said crystal structure.

28. A magnetic article in the form of powder compact or sintered mass of the magnetic material as defined in any of claims 1 and 13.

32. A powdery magnetic material capable of uniaxial alignment upon orientation in a magnetic field to provide magnetic anisotropy, and having a maximum energy product of at least 10 MGOe and an intrinsic coercivity of at least 1 kOe upon sintering, said material having a mean crystal grain size of at least about 1 micron, and consisting essentially of, by atomic percent, 12-20 percent R wherein R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and Y and wherein at least 50% of R consists of Nd and/or Pr, 5-18 percent B, and the balance being at least 62 percent Fe, in which Co is substituted for Fe in an amount greater than zero and not exceeding 25 percent of the material and at least 50 vol. % of the entire material is occupied by a ferromagnetic compound having an (Fe, Co)-B-R type tetragonal crystal structure, and which has a higher Curie temperature than a corresponding ferromagnetic Fe-B-R base compound containing no Co.

33. A powdery magnetic material capable of uniaxial alignment upon orientation in a magnetic field to provide magnetic anisotropy, and having a maximum energy product at least 10 MGOe and an intrinsic coercivity of at least 1 kOe upon sintering, said material having a mean crystal grain size of at least about 1 micron, and consisting essentially of, by atomic percent, 12-20 percent R wherein R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and Y and wherein at least 50% of R consists of Nd and/or Pr, 5-18 percent B, at least one additional element M selected from the group given below in the amounts of no more than the atomic percentages for any one of the elements specified below wherein the sum of M does not exceed the maximum value

of any one of the values specified below for M actually added, and the balance being at least 62 percent Fe, in which Co is substituted for Fe in an amount greater than zero and not exceeding 25 percent of the material and a crystal phase of a ferromagnetic compound having an (Fe, Co)-B-R type tetragonal crystal structure occupies at least 50 vol. % of the entire material: 3.4% T, 6.5% Ni, 5.0% Bi, 6.8% V, 9.6% Nb, 8.3% Ta, 5.4% Cr, 6.1% Mo, 6.0% W, 6.0% Mn, 6.3% Al, 1.3% Sb, 4.2% Ge, 2.0% Sn, 4.2 % Zr, and 4.2% Hf; the magnetic material having a higher Curie-temperature than a corresponding ferromagnetic Fe-B-R-M base composition containing no Co.

34. A magnetic material as defined in claim 1, 13, 32 or 33, wherein said (Fe, Co)-B-R type tetragonal crystal structure has the lattice constants Ao of about 8.8 angstroms and Co of about 12 angstroms.

35. A magnetic article in the form of powder compact of sintered mass of the magnetic material as defined in claim 34.

VII. SSMC '723 Patent

99. The '723 patent titled "Magnetic Materials And Permanent Magnets" and which issued on Sept. 13, 1988 is based on Ser. No. 13,165 filed Feb. 10, 1987 which application is a continuation of abandoned Ser. No. 510,234 filed July 1, 1983. The named inventors of the '723 patent are identical to the named inventors on the '368 patent. The '723 patent is assigned to Sumitomo Special Metals Co., Ltd. The portion of the term of the '723 patent subsequent to July 22,2003 has been disclaimed. (CX-4, CX-12).

100. The '723 patent recites several foreign priority documents, the earliest of which is Japanese 57-145072 (8/21/82) (CX-4). (CX-4, col. lines 8-14).

101. The '723 patent, under the subheading FIELD OF THE INVENTION, discloses that the invention of the '723 patent relates to novel magnetic materials and permanent magnets prepared based on rare earth elements and iron without recourse to cobalt which is relatively

rare and expensive.

102. The '723 patent, under the subheading BACKGROUND OF THE INVENTION, states in part (CX-4, col. 1, lines 25 to 39):

> ..., referring to the permanent magnets, typical permanent magnet materials currently in issue are alnico, hard ferrite and rare earth-cobalt magnets. With a recent unstable supply of cobalt, there has been a decreasing demand for alnico magnets containing 20-30 wt % of cobalt. Instead, inexpensive hard ferrite containing iron oxides as the main component has showed up as major magnet materials. Rare earth-cobalt magnets are very expensive, since they contain 50-65 wt % of cobalt and make use of Sm that is not much found in rare earth ores. However, such magnets have often been used primarily for miniaturized magnetic circuits of high added value, because they are by much superior to other magnets in magnetic properties.

103. The '723 patent, under the SUMMARY OF THE DISCLOSURE, states that objects of the invention are, <u>inter alia</u>, to provide permanent magnets (1) capable of achieving such high magnetic properties that could not be achieved by R-Co permanent magnets, and (2) having magnetic anisotropy, good magnets properties and excellent mechanical strength. (CX-4, col. 2, lines 33 to 44).

104. The '723 patent, under the subheading SUMMARY OF THE DISCLOSURE, stated that objects of the invention are, <u>inter alia</u>, to private magnetic materials and permanent magnets (1) showing good magnetic properties at room temperature, (2) which can be formed into any desired shape and size, and (3) obtained by making effective use of light rare earth elements occurring abundantly in nature. (CX-4, col. 2, lines 30-48).

105. According to the first embodiment of the invention of the '723 patent, there is provided a magnetic material with comprises as indispensable components Fe, B and R (at

least one of rare earth elements inclusive of Y), and in which a major phase is formed of an intermetallic compound(s) of the Fe-B-R type having a crystal structure of the substantially tetragonal system.

106. In issue are claims 2-9, 13-20, 24-27, 31, 33 and 34. Each of independent claims 2, 3, 13 and 14 require the presence of neodymium or praseodymium, boron and iron. (CX-4, col. 24 to 28).

107. Claim 2 of the '723 patent reads as follows:

> A sintered anisotropic permanent magnet having maximum energy product of at least 10 MGOe and consisting essentially of, by atomic percent, 12-20 percent R wherein R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and Y and wherein at least 50% of R consists of Nd and/or Pr, 4-24 percent B and the balance being at least 56 percent Fe.

(CX-4, col. 25, lines 11-18).

108. Claim 3 of the '723 patent reads as follows:

> A sintered anisotropic permanent magnet having a mean crystal grain size of at least about 1 micron and consisting essentially of, by atomic percent 12-20 percent R wherein R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and Y and wherein at least 50% of R consists of Nd and/or Pr, 4-24 percent B and the balance being at least 56 percent Fe, in which at least 50 vol % of the entire magnet is occupied by a ferromagnetic compound having a Fe-B-R type tetragonal crystal structure, said magnet having a maximum energy product of at least 10 MGOe.

(CX-4, col. 25, lines 19-30).

109. Claim 4 of the '723 patent reads as follows:

> A permanent magnet as defined in claim 3, which contains no less than 1 vol. % of nonmagnetic phases.

(CX-4, col. 25, lines 31-32).

110. Claim 5 of the '723 patent reads as follows:

> A permanent magnet as defined in claim 2 or 3 in which Sm is no more than 2 atomic percent in the entire magnet.

(CX-4, col. 25, lines 33-35).

111. Claim 6 of the '723 patent reads as follows:

> A permanent magnet as defined in claim 5, in which the mean crystal grain size is in the range of form 2 to 40 microns.

(CX-4, col. 25, lines 36-28).

112. Claim 7 of the '723 patent reads as follows:

> A permanent magnet as defined in claim 2 or 3 in which Sm is no more than 2 atomic percent in the entire magnet.

(CX-4, col. 25, lines 39-41).

113. Claim 8 of the '723 patent reads as follows:

> A permanent magnet as defined in claim 2 or 3, in which R is about 15 atomic percent, and b is about 8 atomic percent.

(CX-4, col. 25, lines 42-44).

114. Claim 9 of the '723 patent reads as follows:

> A permanent magnet as defined in claim 2 or 3, in which the maximum energy product is no less than 30 MGOe.

(CX-4, col. 25, lines 45-47).

115. Claim 13 of the '723 patent reads as follows:

> A sintered anisotropic permanent magnet having a maximum energy product of at least 10 MGOe and consisting essentially of, by atomic percent, 12-20 percent R wherein R is at leat [sic] one element selected from the group consisting of Nd, Pr, La, Ce,

> Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and wherein at least 50% of R consists of Nd and/or Pr, 4-24 percent B, at least one additional element M select from the group given below in the amounts of no more than the atomic percentages specified below, wherein the sum of M is no more than the maximum value of any one of the values specified below for M actually added and the balance being at least 56 percent Fe: 3.3% Ti, 4.5% Ni, 5.0% Bi, 6.6%V, 10.0% Nb, 8.4% Ta, 5.6% Cr, 6.2% Mo, 5.9% W, 3.5% Mn,6.4% Al, 1.4% Sb, 4.5% Ge, 1.8% Sn, 3.7% Zr, and 3.7% Hf.

(CX-4, col. 26, lines 13-32).

116. Claim 14 of the '723 patent reads as follows:

> A sintered anisotropic permanent magnet having a mean crystal grain size of at least about 1 micron and consisting essentially of, by atomic percent, 12-20 percent R wherein R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and wherein at least 50% of R consists of Nd and/or Pr, 4-24 percent B, at least one additional element M selected from the group given below in the amounts no more than the atomic percentages specified below, wherein the sum of M is no more than the maximum value of any one of the values specified below for M actually added and the balance being at least 56 percent Fe: 3.3% Ti, 4.5% Ni, 5.0% Bi, 6.6%V, 10.0% Nb, 8.4% Ta, 5.6% Cr, 6.2% Mo, 5.9% W, 3.5% Mn,6.4% Al, 1.4% Sb, 4.5% Ge, 1.8% Sn, 3.7% Zr, and 3.7% Hf, in which a crystal phase of a ferromagnetic compound having a Fe-B-R type tetragonal crystal structure occupies at least 50 vol. % of the entire magnet, said permanent magnet having a maximum energy product of at least 10 MGOe.

(CX-4, col. 26, lines 34-59).

117. Claim 15 of the '723 patent reads as follows:

> A permanent magnet as defined in claim 14, which contains no less than 1 vol. % of nonmagnetic phases.

(CX-4, col. 26, lines 60-62).

118. Claim 16 of the '723 patent reads as follows:

> A permanent magnet as defined in claim 13 or 14, in which the mean crystal grain size is in the range of from 1 to 90 microns.

(CX-4, col. 26, lines 63-66).

119. Claim 17 of the '723 patent reads as follows:

> A permanent magnet as defined in claim 16, in which the mean crystal grain size is in the range of from 2 to 40 microns.

(CX-4, col. 26, lines 66-68).

120. Claim 18 of the '723 patent reads as follows:

> A permanent magnet as defined in claim 13 or 14, in which Sm is no more than 2 atomic percent in the entire magnet.

(CX-4, col. 27, lines 1-3).

121. Claim 19 of the '723 patent reads as follows:

> A permanent magnet as defined in claim 13 or 14, in which R is about 15 atomic percent, and B is about 8 atomic percent.

(CX-4, col. 27, lines 4-6).

122. Claim 20 of the '723 patent reads as follows:

> A permanent magnet as define in claim 13 or 14, in which the maximum energy product is no less than 20 MGOe.

(CX-4, col. 27, lines 7-9).

123. Claim 24 of the '723 patent reads as follows:

> A sintered anisotropic permanent magnet as defined in claim 3 or 14 wherein said Fe-B-R type tetragonal crystal structure has the lattice constants a_0 of about 8.8 angstroms and c_0 of about 12 Ao.

(CX-4, col. 27, lines 18-21).

124. Claim 25 of the '723 patent reads as follows:

> A permanent magnet as defined in claim 13 or 14 wherein said additional elements M is at least one selected from the group consisting of V, Nb, Mo, W and Al.

(CX-4, col. 27, lines 22-25).

125. Claim 26 of the '723 patent reads as follows:

> A magnet as defined in claim 25, wherein said additional elements M is contained no more than the amount by atomic percent as specified below: 3.7% V, 6.2% Nb, 4.0% Mo, 3.7% W, and 3.4% Al wherein the sum of M is no more than the maximum value of any one of the values specified above for M actually added.

(CX-4, col. 27, lines 26-27).

126. Claim 31 of the '723 patent reads as follows:

> A sintered anisotropic permanent magnet as defined in claim 2, 3, 13 or 14, wherein R is Nd.

(CX-4, col. 28, lines 38-39).

127. Claim 34 of the '723 patent reads as follows:

> A magnet or material as defined in claim 1, 2, 3, 12, 13, 14, 29 or 30 which is substantially Co-free.

(CX-4, col. 28, lines 47-28).

128. The investigation also includes claims 27 and 33. Claim 27 is dependent on claims 1 or 12 and claim 33 is dependent on claim 32 which is dependent on claims 1, 12, 24 or 30. Claims 1, 12, 27, 30 and 33 read:

> 1. An anisotropic magnetic material having a mean crystal grain size of at least about 1 micron, an intrinsic coercivity of at least 1 kOe and having a maximum energy product of at least 10 MGOe upon sintering, said material consisting essentially of, by atomic

percent, 12-20 percent R wherein R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and Y and wherein at least 50% of R consists of Nd and/or Pr, 4-24 percent B and the balance being at least 56 percent Fe, in which at least 50 vol % of the entire material is occupied by a ferromagnetic compound having a Fe - B-R type tetragonal crystal structure.

12. An anistropic magnetic material having a mean crystal grain size of at least about 1 micron and an intrinsic coercivity of at least 1 kOe and having a maximum energy product of at least 10 MGOe upon sintering, said material consisting essentially of, by atomic percent, 12-20 percent R wherein R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and Y and wherein at least 50% of R consists of Nd and/or Pr, 4-24 percent B, at least one additional element M selected from the group given below in the amounts of no more than the maximum value of any one of the values specified below for M actually added and the balance being at least 56 percent.

27. A magnetic article in the form of powder compact of sintered mass of the magnetic material as defined in any of claims 1 and 12.

30. A powdery magnetic material capable of uniaxial alignment upon orientation in a magnetic field to provide magnetic anisotropy, and having a maximum energy product of at least 10 MGOe and an intrinsic coercivity of at least 1 kOe upon sintering, said material having a mean crystal grain size of at least about 1 micron, and consisting essentially of, by atomic percent, 12-20 percent R wherein R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and Y and wherein at least 50% of R consists of Nd and/or Pr, 4-24 percent B, at least one additional element M selected from the group given below in the amounts of no more than the atomic percentages specified below wherein the sum of M is no more than the maximum value of any one of the values specified below for M actually added and the balance being at lest 56 percent Fe, in which crystal phase of a ferromagnetic compound having a Fe-B-R type tetragonal crystal structure occupies at lest 50 vol % of the entire material:

3.3% Ti,	4.5 % Ni,	5.0% Bi,
6.6% V,	10.0% Nb,	8.4% Ta,
5.6% Cr,	6.2% Mo;	5.9% W,
3.5% Mn,	6.4% Al,	1.4% Sb,
4.5% Ge,	1.8% Sn,	3.7% Zr,
and 3.7% Hf.		

33. A magnetic article in the form of powder compact or sintered mass of the magnetic material as defined in claim 32.

VIII. SSMC '651 Patent

129. The '651 patent titled "Magnetic Materials And Permanent Magnets" and which issued on July 8, 1997 is based on Ser. No. 485,183 filed June 7, 1995. The named inventors of the '651 patent are identical to the named inventors on each of the '368 and '723 patents. The '651 patent is assigned to Sumitomo Special Metals Co., Ltd. (CX-6, CX-14).

130. The '651 patent is related to each of the '368 and '723 patents in that Ser. No. 485,183, on which the '651 patent is based, is a division of Ser. No. 194,647, Feb. 10, 1994, Pat. No. 5,466,308, which is a continuation of Ser. No. 794,673, Nov. 18, 1991, abandoned, which is a continuation of Ser. No. 286,637, Dec. 19, 1988, abandoned, which is a division of Ser. No. 516,841, Jul. 25, 1983, Pat. No. 4,792,368 (in issue), and a continuation-in-part of Ser. No. 224,411, Jul. 26, 1988, Pat. No. 5,096,512, which is a division of Ser. No. 13, 165, Feb. 10, 1987, Pat. No. 4,770,723 (in issue), which is a continuation of Ser. No. 510,234, July 1, 1984, abandoned. (CX-6).

131. The '651 patent recites several foreign priority documents, the earliest of which is Japanese 57-145072 (8/12/82). (CX-6).

132. A comparison of the '723 and '651 patents shows that Figures 14, 15 and 16 of

the ‘651 patent are not found in the ‘723 patent and the tables are not coextensive in the two patents. (CX-4, CX-6).

133. The ‘651 under the subheading BACKGROUND OF THE INVENTION discloses in part (CX-6, col. 1, lines 36-54):

> The permanent magnet materials developed yet include alnico, hard ferrite and samarium-cobalt (SmCo) base materials which are well-known and used in the art. Among these, alnico has a high residual magnetic flux density (hereinafter referred to Br) but a low coercive force (hereinafter referred to Hc), whereas hard ferrite has high Hc but low Br.
>
> Advance in electronics has caused high integration and miniaturization of electric components. However, the magnetic circuits incorporated therein with alnico or hard ferrite increase inevitably in weight and volume. compared with other components. On the contrary, the SmCo base magnets meet a demand for miniaturization and high efficiency of electric circuits due to their high Br and Hc. However, samarium is rare natural resource, while cobalt should be included 50-60 wt % therein, and is also distributed at limited areas so that its supply is unstable.
>
> Thus, it is desired to develop novel permanent magnet materials free from these drawbacks.

134. The ‘651 patent, under the subheading SUMMARY OF THE DISCLOSURE, discloses that an asserted object of the invention of the ‘651 patent is to provide "novel" magnetic materials and permanent magnets based on the fundamental composition of Fe-B-R having an improved temperature dependency of the magnetic properties. (CX-6, col. 2, lines 39-43).

135. The ‘651 patent under the subheading "Summary Of The Disclosure" discloses that the magnetic materials and permanent magnets according to the invention of the ‘651

patent are essentially formed of alloys comprising "novel" intermetallic compounds, and are crystalline, said intermetallic compounds being characterized at least by new Curie points Tc. (CX-6, col. 2, lines 66-67). It further discloses (col. 3, lines 7 to col. 4, line 7):

> According to the first aspect of the present invention, there is provided a magnetic material comprising Fe, B, R (at least one of rare earth element including Y) and Co, and having its major phase formed of Fe - Co - B-R type compound that is of the substantially tetragonal system crystal structure.
>
> According to the second aspect of this present invention, there is provided a sintered magnetic material having its major phase formed of a compound consisting essentially of, in atomic ratio, 8 to 30% of R (wherein R represents at least one of rare earth element including Y), 2 to 28% of B, no more than 50% of Co (except that the amount of Co is zero) and the balance being Fe and impurities.
>
> According to the third aspect of the present invention, there is provided a sintered magnetic material having a composition similar to that of the aforesaid sintered magnetic material, wherein the major phase is formed of an Fe-Co-B-R type compound that is of the substantially tetragonal system.
>
> According to the fourth aspect of the present invention, there is provided a sintered permanent magnet (an Fe-Co-B-R base permanent magnet) consisting essentially of, in atomic ratio, 8 to 30% of R (at least one of rare earth element including Y), 2 to 28% of B, no more than 50% of Co (except the amount of Co is zero) and the balance being Fe and impurities. This magnet is anisotropic.
>
> According to the fifth aspect of the present invention, there is provided a sintered anisotropic permanent magnet having a composition similar to that of the fourth permanent magnet, wherein the major phase is formed by an Fe-Co-B-R type compound that is of the substantially tetragonal system crystal structure.
>
> Fe-Co-B-R base magnetic materials according to the 6^{th} and 8^{th} aspects of the present invention are obtained by adding to the first

-third magnetic materials the following additional elements M, provided, however, that the additional elements M shall individually be added in amounts less than the values as specified below, and that, when two or more elements M are added, the total amount thereof shall be less than the upper limit of the element that is the largest, among the elements actually added (For instance, Ti, V and Nb are added, the sum of these must be no more than 12.5% in all):

4.5% Ti,	8.0% Ni,	5.0% Bi,
9.5% V,	12.5% Nb,	10.5% Ta,
8.5% Cr,	9.5% Mo,	9.5% W,
8.0% Mn,	9.5% Ai,	2.5% Sb,
7.0% Ge,	3.5% Sn,	5.5% Zr,
and 5.5% Hf.		

Fe-B-R-Co base permanent magnets according to the 9^{th} to and 10^{th} aspects of the present invention are obtained by adding respectively to the 4^{th} and 5^{th} permanent magnets the aforesaid additional elements M on the same condition.

Due to the inclusion of Co. the invented magnetic material and permanent magnets have a Curie point higher than that of the Fe-B-R type system or the Fe-B-R-M type system.

With the permanent magnets of the present invention, practically useful magnetic properties are obtained if the mean crystal gain size of the intermetallic compound is in a range of about 1 to 100 um for both the Fe-Co-B-R and Fe-Co-B-R-M systems.

136. Under the subheading "CRYSTAL STRUCTURE," the '651 patent disclosed (col. 22, lines 22-55):

CRYSTAL STRUCTURE

It is believed that the magnetic materials and permanent magnets based on the Fe-Co-B-R base alloys according to the present invention can satisfactory exhibit their own magnetic properties due to the fact that the major phase is formed by the substantially tetragonal crystals of the Fe-B-R type. As already discussed, the Fe-Co-B-R type alloy is a novel alloy in view of its Curie point. As will be discussed hereinafter, it has further been experimentally ascertained that the presence of the substantially tetragonal crystals of the Fe–Co–B–R type contributes to the exhibition of magnetic properties. The Fe–Co–B–R type tetragonal system alloy is unknown in the art, and serves to provide a vital guiding principle for the production of magnetic materials and permanent magnets having high magnetic properties as aimed at in the present invention.

According to the present invention, the desired magnetic properties can be obtained, if the Fe–Co–B–R crystals are of the substantially tetragonal system. In most of the Fe–Co–B–R base compounds, the angles between the axes a, b and c are 90° within the limits of measurement error, and $a_o = b_o \neq c_o$. Thus, these compounds can be referred to as the tetragonal system crystals. The term "substantially tetragonal" encompasses ones that have a slightly deflected angle between, a, b and c axes, e.g., within about 1°, or ones that have a_o slightly different from b_o, e.g., within about 1%.

To obtain the useful magnetic properties in the present invention, the magnetic materials and permanent magnets of the present invention are required to contain as the major phase an intermetallic compound of the substantially tetragonal system crystal structure. By the term "major phase", it is intended to indicate a phase amounting to 50 vol % or more of the crystal structure, among phases constituting the crystal structure.

137. Thereafter under the subheading "EXPERIMENTAL PROCEDURES" the '651 patent disclosed (col. 23, line 2-col. 24, line 67):

(2) The experimental procedures are shown in FIG. 15.
The experimental results obtained are illustrated as below:
(1) FIG. 14 illustrates a typical X-ray diffraction pattern of the Fe-Co-B-Nd(Fe–10Co–8B–15Nd in at %) sintered body showing high properties as measured with a powder X-ray diffractometer. This pattern is very complicated, and can not be explained by any R–Fe, Fe–B or R–B type compounds developed yet in the art.

(2) XMA measurement of the sintered body of (1) hereinabove under test has indicated that it comprises three or four phases. The major phase simultaneously contains Fe, Co, B and R, the

second phase is a R-concentrated phase having a R content of 70 weight % or higher, and the third phase is an Fe-concentrated phase having an Fe content of 80 weight % or higher. The fourth phase is a phase of oxides.

(3) As a result of analysis of the pattern given in FIG. 14, the sharp peaks included in this pattern may all be explained as the tetragonal crystals of a_o=8.80 Å and c_o=12.23 Å).

In FIG. 14, indices are given at the respective X-ray peaks. The major phase simultaneously containing Fe, Co, B and R, as confirmed in the XMA measurement, has turned out to exhibit such a structure. This structure is characterized by its extremely large lattice constants. No tetragonal system compounds having such large lattice constants are found in any one of the binary system compounds such as R–Fe, Fe–B and B–R.

(4) Fe–Co–B–R base permanent magnets having various compositions and prepared by the aforesaid manner as well as other various manners were examined with an X-ray diffractometer, XMA and optical microscopy. As a result, the following matters have turned out:

> (i) Where a tetragonal system compound having macro unit cells occurs, which contains as the essential components, R, Fe, Co and B and has lattice constants a_o of about 9 Å and c_o of about 12 Å, good properties suitable for permanent magnets are obtained. Table 6 shows the lattice constants of tetragonal system compounds which constitute the major phase of typical Fe–Co–B–R type magnets, i.e., occupy 50 vol % or more of the crystal structure.

In the compounds based on the conventional binary system compounds such a R–Fe, Fe–B and B–R, it is thought that no tetragonal system compounds having such macro unit cells as mentioned above occur. It is thus presumed that no good permanent magnet properties are achieved by those known compounds.

TABLE 6

crystal structure of various Fe–R/Fe–Co–B–R type compounds

No.	alloy compositions	structure of major phase (system)	lattice constants of major phase a_0 (Å)	c_0 (Å)
1	Fe–15Pr–8B	tetragonal	8.84	12.30
2	Fe–15Nd–8B	"	8.80	12.23
3	Fe–15Nd–8B–1Nb	"	8.82	12.25
4	Fe–15ND–8B–1Ti	"	8.80	12.24
5	Fe–10Co–15Nd–8B	"	8.79	12.21
6	Fe–20Co–15Nd–8B	"	8.78	12.20
7	Fe–20Co–15Nd–8B–1V	"	8.83	12.24
8	Fe–20Co–15Nd–8B–1Si	"	8.81	12.19
9	Fe–6Nd–6B	body-centered cubic	2.87	—
10	Fe–15Nd–2B	rhombohedral	8.60*	12.50*

N.B.: (*) indicated as hexagonal

(ii) Where said tetragonal system compound has a suitable crystal grain size and, besides, nonmagnetic phases occur which contain much R, good magnetic properties suitable for permanent magnets are obtained,

With the permanent magnet materials, the fine particles having a high anisotropy content are ideally separated individually from one another by nonmagnetic phases, since a high Hc is then obtained. To this end, the presence of 1 vol % or higher of nonmagnetic phases contributes to the high Hc. In order that Hc is no less than 1 kOe, the nonmagnetic phases should be present in a volume ratio between 1 and 45 vol %, preferably between 2 and 10 vol %. The presence of 45% or higher of the nonmagnetic phases is unpreferable. The nonmagnetic phases are mainly comprised of intermetallic compound phases containing much of R, which oxide phases serve partly effectively.

(iii) The aforesaid Fe–Co–B–R type tetragonal system compounds occur in a wide compositional range.

Alloys containing, in addition to the Fe–Co–B–R base components, one or more additional elements M and/or impurities entrained in the process of production can also exhibit good permanent magnet properties, as long as the major phases are comprised of tetragonal system compounds.

As apparent from Table 6 the compounds added with M based on the Fe–B–R system exhibit the tetragonal system as well as the Fe–Co–B–R–M system compounds also does the same. Detailed disclosure regarding other additional elements M as disclosed in the U.S. patent application Ser. No. 510,334 filed on Jul 1, 1983 is herewith referred to and herein incorporated.

The aforesaid fundamental tetragonal system compounds are stable nd [sic] provide good permanent magnets, even when they contain up to 1% of H, Li, Na, K, Be, Sr, Ba, Ag, Zn, N, F, Se, Te, Pb, or the like.

As mentioned above, the Fe–Co–B–R type tetragonal system compounds are new ones which have been entirely unknown in the art. It is thus new fact that high properties suitable for permanent magnets are obtained by forming the major phases with these new compounds.

138. In issue are independent claim 1 and dependent claims 2, 3, 5, 15, 18, 19, 21, and 22 (CX-6, col. 25, 26). Those claims read:

139. Claim 1 of the '651 patent reads as follows:

A crystalline R(Fe,Co)BXAM compound having a stable tetragonal crystal structure having lattice constants of a_0 about 8.8 angstroms and c_0 about 12 angstroms, in which R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and Y, X is at least one element selected from the group consisting of S, C, P, Cu, A is at least one element selected from the group consisting of H, Li, Na, K, Be, Sr, Ba, Ag, Zn, N, F, Se, Te, and Pb, and M is at least one element selected from the group consisting of Ti, Ni, Bi, V, Nb, Ta, Cr, Mo, W, Mn, Al, Sb, Ge, Sn, Zr, Hf and Si.

(CX-6, col. 25, line 52 - col. 26, line 6).

140. Claim 2 of the '651 patent reads as follows:

> The crystalline compound of claim 1, wherein (Fe,Co) comprises Fe and Co, provided that Co is present in an amount up to 50 atomic % of the sum of Fe and Co.

(CX-6, col. 26, lines 7-9).

141. Claim 3 of the '651 patent reads as follows:

> The crystalline compound of claim 1, wherein (Fe,Co) comprises Fe and Co, provided that Co is present in an amount up to 50 atomic % of the sum of Fe and Co.

(CX-6, col. 26, lines 10-12).

142. Claim 5 of the '651 patent reads as follows:

> The crystalline compound of claim 1, wherein in the group (Fe,Co) Co is not present.

(CX-6, col. 26, lines 15-16).

143. Claim 15 of the '651 patent reads as follows:

> The crystalline compound of claim 1, wherein M is selected from the group consisting of V, Si, and Al.

(CX-6, col. 26, lines 33-34).

144. Claim 18 of the '651 patent reads as follows:

> The crystalline compound of claim 1, wherein said compound has a crystal size of at least 1 μm.

CX-6, col. 26, lines 39-40.

145. Claim 19 of the '651 patent reads as follows:

> The crystalline compound of claim 1, wherein at least 50 atomic % of R is at least one element selected from the group consisting of Nd and Pr.

(CX-6, col. 26, lines 41-43).

146. Claim 21 of the '651 patent reads as follows:

> The crystalline compound of claim 1, wherein R is at least one element selected from the group consisting of Nd, Pr, Tb, Dy and Ho.

(CX-6, col. 26, lines 45-47).

147. Claim 22 of the '651 patent reads as follows:

> The crystalline compound of claim 1 which has magnetic anisotropy.

(CX-6, col. 26, lines 48-49).

IX. Prosecution Of The Claims In Issue Of The '395 Patent

148. While the '395 patent is based on Ser. No. 274,070 filed June 16, 1981, claims 13, 14, 15, 16 , 17 and 18 which are in issue were not introduced into Ser. No. 274,070 until the "Supplemental Amendment Paper No. 12" was filed on September 26, 1983 and the "Supplemental Amendment And Statement Of Relevant Prior Art Paper No. 13" was filed on March 5, 1984. In Paper No. 12, filed September 26, 1983 applicant added claim 46 which ultimately became claim 13 in issue (CX-22, M 002901). In Paper No. 13, filed March 5, 1984 applicant added claims 47, 48, 49, 50 and 51 which ultimately became, after some minor amendments, claims 14, 15, 16, 17 and 18 in issue (CX-22, M 002902-2903). In an Office Action dated October 16, 1982, the Examiner rejected all original claims 1 to 15. Certain of said claims were rejected on prior art which included Ostertag U.S. Pat. No. 3,421,889. Nesbitt et al Patent Nos. 3,615,911 and 3,560,200, inter alia were cited but not used in any rejection. (CX-23, Tab 8).

149. In the prosecution of Ser. No. 274,070 Paper No. 11, titled "Amendment And

Request For One Month Extension Of Time" filed September 12, 1983 (CX-23, Tab 11), added method claims 31 to 44 and composition of matter claim 45. Claim 45, became claim 12 of the '395 patent. (CX-22, M 002888). Claim 12 which is not in issue recites as the rare earth elements neodymium, samarium and praseodymium. (CX-3). In the "Remarks" of Paper No. 11, it was argued:

> This invention relates to a new family of rapidly quenched rare earth-iron alloys for permanent magnets which alloys have high intrinsic magnetic coercivities at room and elevated temperatures (up to about 300°C). Before this invention it was widely believed that the light rare earth elements, particularly the light rare earth elements neodymium and praseodymium could not be alloyed with the transition metal element iron to make useful permanent magnets. (See, e.g., the enclosed article "Magnetic Properties of Rare-Earth-Iron Intermetallic Compounds", K. Strnat et al, <u>IEEE Transactions on Magnetics</u>, Vol. Mag-2, No. 3, September 1966, page 492, column 2, first full paragraph). Either magnetic intermetallic phases of light rare earth elements and iron would not form or the phases that would form had unacceptably low Curie temperatures.
>
> While others have made magnetically coercive alloys from compositions containing heavy rare earth elements and iron, before this invention, no one had made permanently magnetizable alloys from the light rare earth elements and iron. Furthermore, no one had ever made any rare earth-iron alloy that could be used directly as quenched (i.e. without annealing and/or grinding and magnetic prealigment) to make permanent magnets ...
>
> * * *
>
> Claims 32 to 45 in this application are drawn to rapidly solidified neodymium, praseodymium, samarium-iron based alloys which exhibit surprisingly high intrinsic magnetic coercivities when they are quenched from the melt by a controlled solidification process such as melt-spinning. The alloys are characterized by the formation of a permanently magnetic phase which is stable at room and elevated temperatures and has a substantially amorphous to very finely crystalline microstructure as

determinable by X-ray powder diffraction techniques.

* * *

Claims 32 to 45 are limited to neodymium, praseodymium and samarium as the principal rare earth constituent and iron as the principal transition metal constituent of the subject permanent magnet alloys. Savage et al [U.S. Pat. No. 4,308,474 (M002 787)] relates only to magnetically soft alloys of iron and terbium, dysprosium, holmium or blends of these heavy rare earth elements with samarium. Therefore, there is no overlap in the constituent formulas of Savage et al and the claims now in the case.

* * *

Further, claim 45, [which became claim 12 of the '395 patent] is not obvious in view of Ostertag et al [U.S. Pat. No. 3, 421,889] because cobalt and iron are nonanalogous alloy constituents in the fabrication of permanent rare earth-iron magnets. As noted in the Strnat et al article, cited above, iron compounds corresponding to known intermetallic cobalt compounds either do not exist or they have such low Curie temperatures that they are impractical. (See also, the compilations of rare earth-transition metal intermetallic compounds in "FERRO-MAGNETIC MATERIALS, A handbook on the properties of magnetically ordered substances, by E.P. Wohlfarth, Vol. 1, page 388 (1980), "Intermetallic Rare-earth Compounds", by K.N.R. Taylor, <u>Advanced Physics</u>, Vol. 20, page 616 (1971), and "Rare Earth Permanent Magnets", by E.A. Nesbitt et al, <u>Academic Press</u>, page 67 (1973). Applicant does not believe that the Nd_6Fe_{23} phase actually exists since repeated attempts to duplicate the compounds were unsuccessful.) The enclosed article from Russian Metallurgy, No. 3, page 50 (1965) includes a Nd-Fe phase diagram that shows that the only identified intermetallic compound of iron and neodymium is Nd_2Fe_{17} which has an unacceptably low Curie temperature. Praseodymium would be expected to have a similar phase diagram.

Thus, Ostertag et al neither anticipates nor suggests Claim 45 because the magnetic phase of applicant's rapidly quenched alloys simply would not form if the combined rare earth elements and iron were processed by Ostertag's slow solidification method.

* * *

The inventor, Dr. John Croat, was invited to give a paper at the IEEE Magnetics meeting in November 1982. A copy of his paper entitled "Permanent Magnet Properties of Rapidly Quenched Rare Earth-Iron Alloys" which was presented at the meeting is enclosed because it may clarify some the Examiner's questions about this application. It contains information about the claimed products that would be readily ascertainable by one skilled in the art if he were given samples of the permanent magnetic alloys to characterize.

Figure 3 of the paper compares the intrinsic coercivities of melt-spun and sputtered samples of praseodymium iron alloy after anneal. Sputtered praseodymium iron could not be annealed to a coercivity greater than 1,000 Oesteds. The reason for this is in all likelihood because applicant's metastable intermetallic compounds of light rare earth elements and iron do not form when the constituent elements are sputtered rather than rapidly quenched. Sputtering is a process by which atoms are randomly deposited on a substrate <u>one</u> by <u>one</u> to yield a completely amorphous solid. It is applicant's belief that controlled rapid solidification, which produces at least short range atomic ordering of the constitutes, is necessary to form metastable Nd, Pr and Sm-Fe magnetic phases with high intrinsic coercivity.

Figure 1 of Croat's paper lists rare earth elements with their orbital quantum number, valences and ionic radii. The headings RFe relate to intermetallic compounds. A blank box means that no such compound forms, hashed box means that an intermetallic compound forms with a Curie temperature greater than 450° K forms. Generally, materials with Curie temperatures less than 450° K are not considered good candidates for permanent magnets because they are to easily demagnetized in ordinary use. The table shows that neodymium and praseodymium iron intermetallic compounds do not form except in the ratio 2:17 and here, the Curie temperature (about 330° K) is so low that the RE_2Fe_{17} compounds are not practical for magnets. Applicant has obviously created alloys with high Curie temperatures and coercivities over a broad rare earth-iron compositional range. The fact that stable magnetic phases do not form when such compositions are cooled slowly emphasizes the great significance rapid solidification has on the products claimed herein.

(CX-22, M 002890-2899)

150. In the REMARKS section of Paper No. 13, filed March 5, 1984 which added claims 47, 48, 49, 50 and 51, which became claims 14, 15, 16, 17 and 18 in issue, it was stated:

> A copy of the recent article "Powerful New Magnet Material Found" which appears in the March 2, 1984 issue of Science magazine is enclosed for the Examiner's information. While GM [General Motors] to which the '395 patent was originally assigned] takes issue with some of the "facts" as they are set out in the Science Article, it is being brought to the PTO's attention because it is indicative of the excitement that has been generated by Dr. Croat's discovery of light rare earth-iron permanent magnets. Because of the obvious significance of this patent application to GM, Claims 47-51 are being added at this time to further clarify and distinctly claim the invention.
>
> The Science article makes note of the work of several others in the fields of rare earth element magnets and metallurgy. It makes particular reference to a 1979 Russian publication of neodymium-iron-boron phase diagrams (Science, p. 921, col. 3, para. 2). A copy of the Russian text and an English translation are also enclosed for the Examiner's information.
>
> While the author of the Science article seems to put great stock in this Russian article, it is not relevant to any rejection of claims in this case because it fails to teach or suggest that rare earth-iron alloys are or could be permanently magnetic. It is not possible to determine or predict the magnetic characteristics of metal alloys by looking at their phase diagrams! Thus a researcher looking for a new magnetic alloy would not have any greater incentive to look at Nd-Fe phase diagrams than at any of thousands of other iron alloy diagrams - - except to explain results that had already been achieved. Before the invention claimed herein, those skilled in the magnetic art did not consider light rare earth-iron alloys to be viable candidates for making permanent magnets. As a further point of information on the Russian article, GM's research indicates that the $R_3Fe_{16}B_1$ phase reported by the Russians does not exist and that it is a stable $R_2Fe_{14}B$ phase (shown in the figure on page 921 of the Science article) that is the primary source of

> hard magnetism in suitably processed, boron-containing, rare earth-iron alloys.
>
> The Science article also mentions the work of Arthur Clark at p. 921, col. 1, par. 2. This work is covered in the Clark article "High Field Magnetization and Coercivity of Amorphous RE-Fe Alloys", Applied Physics Letters, Vol. 23, No. 11, Dec. 1973 which is already of reference in this case.
>
> Work of Norman Koon and Badri Das is also mentioned at p. 921 col. col. 2 of the Science article. This work is the subject matter of recently issued U.S. Patent Nos. 4,409,043; 4,402,770; 4,375,372 and 4,374,665. These patents are not effective references to this application because they were filed later (October 23, 1981). They are also limited to compositionally different alloys which must contain substantial amounts of boron, lanthanum, heavy rare earth elements and iron but no more than 2% total of the light rare earth elements cerium, neodymium and praseodymium.

(CX-23, Tab 15) There were no remarks by the applicant when he filed on September 26, 1983 Paper No. 12 which added claim 46 that ultimately became claim 13. (CX-22, M 002901).

151. In an Office Action dated May 18, 1984 (CX-22, M 002926-2937) certain claims, including claims 48-51, were rejected under 35 U.S.C. § 112, first paragraph as directed to new matter. Also claims 46 to 51, inter alia, which because the claims in issue were rejected as based on insufficient disclosure. Certain claims including claims 50 and 51 were rejected under 35 U.S.C. § 112 , second paragraph, as being indefinite for failing to particularly point out and distinctly claiming the subject matter which the applicant regards as his invention. Claims 46, 50 and 51, inter alia, were further rejected under 35 U.S.C. § 112, first paragraph, "as the disclosure is enabling only for claims limited in accordance with the disclosure at page 9, lines 10 to 13 of the specification." Claims 46-51, inter alia, were also

rejected over Savage et al U.S. Patent No. 4,308,474, the Examiner stating that the reference teaches "iron-rare earth alloys in proportions overlapping applicant's." Claims 46 to 51, inter alia, and which became the claims in issue were further rejected under 35 U.S.C. § 102(a) as anticipated by or, in the alternative, under 35 U.S.C. § 103 as obvious over Wallace at al. U.S. Patent No. 3,102,002. The Examiner stated that the Wallace et al patent teaches "a rare-earth transition metal permanent magnetic alloy" and that applicant's claimed composition does not distinguish over Wallace et al's alloy and that in view of the overlap in proportions and the lack of any evidence to the contrary, their alloy of Wallace et al would be expected to have the same properties, i.e., coercive force, as applicant's alloy. Claims 37 and 45 were also rejected under 35 U.S.C. § 102(a) as anticipated by or, in the alternative, under 35 U.S.C. § 103 as obvious over Clark.

152. In an amendment dated September 18, 1984 (M 003065-3079), applicant relied on an affidavit of Alden E. Ray under Rule 112 (M 002938-3064) in arguing the rejections set forth in the Office Action dated May 18, 1984.

153. The Examiner in an Office Action dated October 11, 1984 stated inter alia that the Alden E. Ray affidavit was insufficient to overcome the rejection of claims 46 to 51 based upon Savage et al and Wallace et al "because the affidavit is a statement of Mr. Alden E. Ray's opinions with no data or evidence to substantiate his opinions." (CX-22, M 003082-003083).

154. Applicant, in a supplemental amendment dated November 5, 1984, argued (CX-22, M 003087-3090):

> Claims 31 to 39 and 41 to 51 have been rejected as obvious over

USPN 4,308,474 to Savage et al. The only remaining issue of patentability of the subject claims over Savage et al. is whether or not easy domain wall movement (see Savage et al. at col. 1, line 58; Col. 2, line 63; Col. 3, line 23, e.g.) is the same as soft magnetism.

A copy of a booklet put out by Hitachi Magnetics Corporation accompanies this paper. At page 5, Col. 1, near the bottom of the first full paragraph it is noted "The (domain) boundaries of soft magnetic materials must be made easy to move in response to low fields, whereas the boundaries of permanent magnets must be made difficult to move so they will resist demagnetizing fields."

The magnetostricters disclosed by Savage are particularly characterized by their easy domain boundary movement at very low fields of only a few Oersteds. The domain walls of Applicant's claimed magnets do not move at fields less than 1,000 Oersteds. Therefore, all Savage et al.'s crystalline alloys are soft magnets which do not obviate Applicant's high coercivity hard magnets.

Claims 37 to 40 and 45 to 51 have been rejected as obvious over USPN 3,102,202 to Wallace et al. The only remaining issue of patentability of the subject claims over Wallace et al. is whether Applicant's rapid solidification method produces a different product than Wallace et al.'s quench method.

Wallace et al describes his alloy solidification step at col 4, line 32. "The molten samples were ...dropped into a large copper mold. The copper mold. The copper mold rapidly dissipated the heat and solidification took place very rapidly."

All Applicant's melt spun samples were quenched against a rotating copper wheel plated with chromium. Referring to Figures 2-5 of the subject application, it is readily apparent that intrinsic coercivity (i.e., the measure of permanent magnetism) quickly approaches zero as the quench wheel is slowed down. At zero wheel speed, none of the alloys would be permanently magnetic.

Operating Applicant's quench wheel at zero wheel speed is equivalent to Wallace et al.'s method of quenching in a copper mold. Referring to Applicant's figures 2-5 it is apparent that both the processes yield magnetically soft products. Accordingly, Applicant's claims to hard magnets are unobvious over Wallace et al.

Claims 37 and 45 have been rejected as obvious over Clark's article "High-field magnetization and coercivity of amorphous rare-earth-Fe_2 alloys". The only remaining issue of patentability of the subject claims over Clark is whether Applicant's rapid solidification method produces a different product than Clark's method.

The inventor here, Dr. John Croat, reports data to this point in his article Permanent Magnet Properties of Rapidly Quenched Rare Earth-Iron Alloys, IEEE Transactions on Magnetics, Vol. MAG-18, No. 6, Nov. 1982. Figure 3 of the Croat paper shows that Pr-Fe alloy sputtered and annealed by Clark's method develop substantially less than 1,000 coercivity. The same alloy processed by melt spinning develops more than 2,000 Oersteds coercivity. Thus, the strong permanent magnets of Claims 37 and 45 are clearly unobvious over Clark.

Based on her interviews with the Examiner, Applicant's attorney believes that the paragraphs above refute each remaining ground for rejection of the claims under 35 USC 103. It is therefore respectfully requested that this amendment be entered, all claims be allowed and the case be passed to issue.

155. The Examiner in an Office Action dated December 11, 1984 allowed, inter alia, claims 46-51 which claims became the claims in issue. (CX-22, M 003092-3093).

X. Prosecution Of The Claims In Issue Of The '058 Patent

156. While the '058 patent is based on Ser. No. 414,936 filed September 3, 1982 none of the claims in issue were introduced into the application until the amendment dated September 26, 1984 was filed. (CX-16, M 001730-1739; CX-17, Tab 8). In that amendment applicant added claims 15 thru 25. Thereafter following an amendment, claim 15 became claim 1 in issue; following three amendments, claim 24 became claim 4 in issue; following

four amendments claims 26 became claim 5; following four amendments claim 30 became claim 9; and following three amendments claim 32 became claim 11. (CX-16, M 001845-1851). In an amendment dated October 19, 1984 applicant added claim 29, inter alia (CX-16, M 001740-1746) which following three amendments became claim 8 issue. (CX-16, M 001834).

157. Applicant in an "Updating Of Information Disclosure Statement Under 37 C.F.R. 1.99" dated Nov. 7, 1985 (CX-17 Tab 16) cited Koon et al "Magnetic Properties of Amorphous and Crystallized $(Fe_{0.82}B_{0.18})_{0.9}Tb_{0.05}La_{0.05}$," Applied Physics Letters, Vol. 39 No. 10, pp. 840-842, November 15, 1981. The Examiner, in an Office Action dated 2/20/85 (CX-17, Tab 10), rejected claims 26 and 30 inter alia under 35 U.S.C. § 102(a) as anticipated by or, in the alternative, under 35 U.S.C. § 103 as obvious over Koon U.S. Patent No. 4,402,770 on the ground that Koon teaches a magnetically hard alloy containing a rare earth element selected from Ce, Pr, Nd and mixtures thereof, La, B and Fe, Co and/or Ni. Claim 30, inter alia, was rejected under 35 U.S.C. § 103 as being unpatentable over Japanese patent documents 56-47538. Claims 15, 24, 26, 29, 30 and 32, inter alia, were rejected under 35 U.S.C. § 103 as being unpatentable over Japanese documents 57-141901. Claims 15, 24, 26, 29, 30 and 32, inter alia were also rejected as claiming the same invention as that of claims 1 to 6, 8 to 20, and 26 to 32 of applicant's copending application Serial No. 544,728 on which the '931 patent is based.

158. The Examiner, in an "Examiner Interview Summary Record" (CX-17, Tab 11) dated 3/26/85 stated that a declaration swearing that the original oath was signed on August 19, 1982 would be sufficient to overcome Japanese reference 57-14 1901 dated Sept. 2, 1982.

159. In an amendment dated June 10, 1985, in the Remarks in the prosecution of the '058 patent it was stated. (CX-17, Tab 12).

> The symbol ≤ was used in the specification at page 23, for example, and is a well-known mathematical symbol which means less than or approximately equal to. If the Examiner wishes, he may amend the claims by inserting the words, "less than or approximately equal to," each place where the symbol is now used.
>
> All claims are now limited to at least about 10 atomic percent Nd and/or Pr. This is supported at Example 5, page 16, and Figure 5 of the application, for example, where remanence is plotted as a function of quench rate for a 10% Nd alloy. Other rare earth elements are also suitable in conjunction with Nd and/or Pr as set forth in particular at page 11, paragraph 2, of the specification. Similarly, all compositions require at least about 50 atomic percent iron but other transition metal elements may be present as set forth, for example, at page 11, paragraph 3, of the specification.
>
> Claims 21, 26, 30 and 31 have been rejected as anticipated under 35 U.S.C. 102(a) or obvious under 35 U.S.C. 103 in view of U.S. patent 4,402,770 to Koon. These claims have been amended to specifically require at least 10 atomic percent of neodymium and/or praseodymium. Koon specifically states that the non-preferred lanthanides include neodymium and praseodymium and that these rare earths <u>must not be present in concentrations more than 2 atomic percent</u> (Koon '770, column 2, lines 46-50). Therefore, claims 21, 26, 30 and 31 are well outside the compositional ranges of Koon '770. Koon teaches away from using more than 2 percent Nd and/or Pr to make permanent magnets.
>
> Claims 30 and 31 have been rejected under 35 U.S.C. 103 as being unpatentable over Japanese patent document 47538. Claims 30 and 31 have been amended to recite the requirement of at least about 50 atomic percent iron based on the total composition. Therefore, Applicant's compositions fall outside of the range of compositions taught or suggested in the Japanese patent document. Moreover, the Japanese reference clearly relates to magnets based on RE_2Co_{17} compositions where RE is

> predominantly a heavy rare earth and where copper is included as a sintering aid. This is a different family of compositions than the rare earth-iron-boron compositions taught and claimed by Applicant in the subject application.
>
> Claims 15, 21, 22, 24 and 26-32 are rejected under 35 U.S.C. 103 as unpatentable over Japanese document 57-141901. In accordance with 37 CFR 1.131 the grant of a patent shall not be barred by reference to a printed publication if Applicant shall make oath as to facts showing completion of the invention in this country before the date of the printed publication. The publication and effective date of Japanese '901 is September 2, 1982. The attached affidavit of Dr. John Croat, Applicant, swears to facts showing reduction to practice of the subject invention in the United States before August 19, 1982, the date on which the Declaration and Power of Attorney for USSN 414,936 was signed. Accordingly, Japanese '901, published only one day before Applicant's filing date, shall not bar the grant of claim in this application.

160. The Examiner, in an "Examiner Interview Summary Record" dated 8/13/85 (CX-17, Tab 14) stated that claims 15, 21, 22, 24 and 26-32 as well as Koon U.S. Patent No. 4,402,770, and Japanese 56-4753 and 57-141 901 were discussed and that it appears, based on papers filed, that the rejections are overcome.

161. The Examiner, in an "Examiner Interview Summary Record" (CX-17, Tab 19) dated 2/13/86 and 2/14/86 stated that the Examiner had explained that claims 24, 26, 30 and 32 would be rejected over Kabacoff et al; that applicant's attorney proposed adding the language "at room temperature" to the end of claims 24 and 26 and inserting the phrase "having an intrinsic coercivity of at least about 1000 Oersteds at room temperature," after the word "composition" in line 2 of claims 26 and 32; and that the Examiner indicated that such would obviate the prospective rejection over Kabacoff.

162. The Examiner in an Office Action (CX-17, Tab 20) dated 3/10/86 stated that

claims 15, 21, 22, 27 to 29 and 31 were allowed while claims 24, 26, 30 and 32 were rejected over Kabacoff et al.

163. Applicant, in an amendment dated 4/8/86 (CX-17, Tab 21) stated:

> Claims 15, 21, 22, 27 to 29, and 31 have been allowed. Claims 24, 26, 30 and 32 [became claims 4, 5, 6 and 11 in issue] have been rejected as obvious over the article by Kabacoff et al. Kabacoff et al was published less than one year before Applicant's filing date. However, even if it is considered, the article relates only to magnetically soft compositions and does not teach or suggest Applicant's magnetically hard compositions with high magnetic coercivities at room temperature. Accordingly, rejected Claims 24, 26, 30 and 32 have been amended as discussed in our telephone interview to specifically recite that Applicant's invention relates to materials with high magnetic coercivities at room temperatures.
>
> In that the Examiner has indicated that the claims rejected over Kabacoff et al would be allowed if amended as above, and in that all other claims have been allowed, it is respectfully requested that the application be passed to issue or otherwise expedited towards that end as quickly as possible.

164. The Examiner, in an "Examiner Interview Summary Record" (CX-17, Tab 22) dated 5/22/86 stated that:

> Attorney called regarding status of application. The Examiner explained that the rejection based on Kabacoff would be maintained in that the Hc of less than 50e was for the amorphous alloy and that a crystalline permanent magnet is clearly taught by reference. Applicant's attorney disagreed.

165. The Examiner in an Office Action (CX-17, Tab 25) dated 7/25/86 stated:

> Claims 15, 21, 22, 24 and 26 to 32 are rejected under 35 U.S.C. 103 as being unpatentable over Kabacoff et al.
>
> Kabacoff et al. teach an amorphous magnetic composition consisting of, in atomic percent, 0 to 30% Pr, 56 to 80% Fe and 14 to 20% B. Kabacoff et al. also teaches the use of this

composition as a precursor to a magnetically hard crystalline magnet (page 2255 Introduction). Applicant's claimed magnetic composition does not distinguish over the permanent Fe-B-Pr magnet suggested by Kabacoff et al.

166. Applicant in an amendment dated Oct. 9, 1986 (CX-17, Tab 26) argued as follow with respect to the rejection over Kabacoff et al.:

> All claims now in the case have been rejected under 35 U.S.C. 103 as obvious over Kabacoff et al. The rejection cites Kabacoff as teaching permanently magnetic crystalline praseodymium-iron-boron compositions.
>
> The Examiner relies heavily on the introduction of the reference where Kabacoff states the objective of the magnetics community to make permanent magnets based on the rare earth elements and iron.
>
> While most work on ferromagnetic metallic glasses has centered on magnetically soft materials, there is also an interest in the development of glasses containing Fe and rare earths either directly as permanent magnets or as precursors for new crystalline phases with hard magnetic properties. (Emphasis added).
>
> The article then sets forth data obtained in connection with Kabacoff's production of rapidly solidified, magnetically soft, amorphous, Pr-Fe-B alloys. He notes at page 2256, col. 1 that:
>
> > The coercive force at room temperature was too small to be measured on the vibrating sample magnetometer (<5 Oe).
>
> At the end of the discussion section he notes:
>
> > What was surprising about the results was the failure to detect a coercive force using this instrument (the vibrating sample magnetometer). This puts a very conservative upper limit on H_c of 5 Oe.
>
> The article concludes with the statement:

> The values of Hc in crystallized samples of the present alloys will be presented subsequently.

The Examiner states in the last paragraph on page 3 of the July 25th Office Action.

> Kabacoff et al. disclosure is not limited to magnetically soft amorphous compositions. Instead the Examiner contends that Kabacoff et al. clearly suggest crystalline Fe-B-Pr permanent magnet compositions (see Introduction).

The conclusion on the Examiner's part that Kabacoff teaches Applicant's permanent magnet compositions makes sense only when read in light of Croat's disclosure in the subject application.

A reading of the Kabacoff reference without 20:20 hindsight would lead one skilled in the art to conclude that Kabacoff desired, as had all workers in the art, to make permanently magnetic rare earth-iron based compositions. His plan was to do it by making amorphous precursors and annealing them.

In that vein, Kabacoff made amorphous Pr-Fe-B alloys and measured their magnetic properties. He seemed to expect relatively high coercivity (i.e., permanent magnetism) in these materials in view of work by Croat and Koon but was surprised to find his samples had an upper coercivity limit of 5 Oe - very soft magnets. He crystallized numerous samples of varying composition (i.e., heated them to T_x) and determined that several different crystal phases formed in them.

There is no evidence in the paper that Kabacoff actually made any permanent magnets even though it is very apparent that he (and everyone else) hoped to do so. Therefore, one skilled in the art considering the Kabacoff paper (without already knowing about the subject invention) would have had to conclude that Kabacoff did not and could not make permanent RE-Fe magnets. The reference would, therefore, have drawn one skilled in the art away from pursuing the concept of making permanent rare earth-iron magnets by crystallizing amorphous precursors.

A copy of an Affidavit of Lawrence T. Kabacoff under 37 C.F.R. 1.132, originally submitted in related USSN 544,728, is

> offered herewith in support of the nonobviousnes of the rejected claims over the cited article.
>
> The Examiner's rejection is based upon a mode or capability of operation attributed to Kabacoff's samples - i.e., that they were permanently magnetic. The Affidavit clearly rebuts the basis for the Examiner's rejection. Dr. Kabacoff has very candidly and forthrightly sworn that all samples made in connection with the article which were measured for magnetic coercivity were magnetically soft. The Affidavit further shows that Dr. Kabacoff intended to pursue the creation of RE-Fe-B permanent magnets but had not done so as of April 4, 1983. On this date (which is well after the September 3, 1982 filing date of this application, he discovered that George Hadjipanayis had made melt-spun and heat-treated Pr-Fe-B containing alloys which were permanently magnetic. Upon finding that someone else had already accomplished his goal, he did not pursue additional research related to magnetically hardening RE-Fe-B alloys. He also did not follow-up on the suggestion in his cited paper that values of H_c in crystallized Pr-Fe-B samples would be published.

167. The Examiner in an Office Action (CX-17, Tab 27) dated 2/4/87 stated that while the affidavit under 37 CFR 1.132 filed October 9, 1986 was sufficient to overcome the rejection of claims 15, 21, 22, 24 and 26 to 32 based upon Kabacoff et al., those claims were "provisionally" rejected under 35 U.S.C. § 101 as claiming the same invention as that of claims 40 to 50 and 72 in copending application Ser. No. 544,728. The '931 patent in issue is based on Ser. No. 544,728. (CX-2).

168. Applicant, in an amendment (CX-17, Tab 29) dated April 6, 1987 in the "Remarks" section argued:

> Applicant and his attorneys gratefully acknowledge the telephone interview afforded by the Examiner on March 12, 1987. Several of the claims have been amended as agreed during the interview. For the most part, these amendments involve the addition of compositional ranges for the rare earth elements and the transition metals.

* * *

It is recalled that Dr. Croat discovered that iron-neodymium and iron-praseodymium based compositions could be rapidly solidified to form products having permanent magnet properties. That discovery was disclosed and claimed in his U.S. Patent No. 4,496,395. The subject application describes and claims improved compositions that incorporate boron. The addition of boron to iron-neodymium alloys, for example, provides a substantial increase in magnetic properties such as coercivity and Curie temperature. In the experience reflected in the many examples presented in the subject application, the preferred addition of boron to iron and neodymium or praseodymium based compositions in such that boron makes up about 0.5 to 10 atomic percent of the total composition. Particularly desirable permanent magnetic properties were observed in such mixtures described in the working examples of this application. However, there is no suggestion in the application and indeed no technical basis for concluding from its teaching that higher boron additions are unsuitable for achieving improvements in magnetic properties in iron-neodymium-praseodymium based compositions. To the contrary, in the brief summary portion of the specification at pages 3 and 4, it is stated with reference to the basic formula $RE_{1-x}(TM_{1-y}B_y)_x$ that the value of x is preferably in the range of about 0.5 to about 0.9 and y is preferably in the range of about 0.01 to about 0.20. Accordingly, in this disclosure of a preferred practice of the invention, the boron content could be at least about 18 atomic percent of the overall basic formula. In general, the specification points out benefits of combining boron with iron and neodymium and/or praseodymium. There is no suggestion that boron content in excess of amounts described as preferred so change the magnetic properties of the overall compositions as to be outside the scope of the invention.

Claim 24 [which became claim 4 in issue] (like claims 26, 30 and 32) [which became claims 5, 9 and 11 in issue] is presented in the application to recite the invention in a different form than other claims. Claim 24 requires that a magnetically hard alloy composition be formed and that it contain a specified range of rare earth elements and iron and a minimum amount of boron. However, the claim requires these compositional recitations to cooperate such that the resultant material has an intrinsic magnetic coercivity of at least 5,000 Oersteds at room

> temperature. Claims 26, 30 and 32 recite the inventions in like terms. They provide compositional ranges for two of the necessary constituent element types, they provide a minimum amount of the third necessary constituent, boron, and they require that the overall material cooperate to provide certain minimum permanent magnet properties. The law does not require applicant's claims to provide a detailed recipe of his permanent magnets. The law requires the claims to distinctly claim the invention. It is respectfully submitted that claims 24, 26, 30 an 32 accomplish this requirement and satisfy 35 USC 112.
>
> As regards the provisional double patenting rejection, applicant would like to establish the patentability of the pending claims in this application. Of course, the issue of double patenting can be resolved by retaining the claims in the application and deleting them from Serial No. 544,728 or vice versa. In view of the prospect of an interference involving these claims, applicant's attorney prefers to continue the prosecution in this application and will deal with the matter of prospective double patenting later.

169. The Examiner in an Advisory Action (CX-17, Tab 30) dated 4/15/87 stated that claims 15, 21, 22, 24 and 26 to 32 were rejected "as set forth in the double patenting rejection" and the the rejection of claims 15, 21, 22, 24 and 26 to 32 "on references is deemed to be overcome by applicant's response."

170. The Examiner in an Examiner Interview Summary Record (CX-17, Tab 33) dated 5/12/87 stated that he had advised that attorney that in view of claim 72 in 544,758 (on which the '931 patent in issue is based), the double patenting rejection would be maintained and that the attorney indicated he would cancel said claim 72.

171. The Examiner in a 1987 Office Action (CX-17, Tab 36) stated that while all claims were allowable, due to a potential interference, <u>ex</u> <u>parte</u> prosecution was suspended for six months.

172. The Examiner in a "Notice Of Allowability" dated (CX-17, Tab 41) stated that the allowed claims were claims 15, 21, 22, 24 and 26 to 32, and the '058 patent issued on July 25, 1989. (CX-1).

173. The Patent Office Board of Interferences in a Notice of Interference dated 8/11/93 (CX-17, Tab 46) indicated that interference No. 103,182 was declared involving Croat's claims 1 through 20 of U.S. Pat. No. 4,802,931 and claims 1 through 11 of U.S. Pat. No. 4,851,058 with Croat as the junior party and Norman C. Koon's claims 1 thru 31 and 34 of reissue 07/248,217 with Koon as the senior party. Count 1 of the interference read:

<u>COUNT 1</u>

> A permanent magnet alloy composition comprising, in atomic percent, 6 to 40 percent of at least one rare earth metal, 0.75 to 28.75 percent boron, 50 to 90 percent of at least one transition metal selected from the group consisting of iron and cobalt, 0 to 4.75 percent of at least one element selected from the group consisting of phosphorus, silicon, aluminum, arsenic germanium, indium, antimony, bismuth, and tin and from 0 to less than 20 percent based upon the iron content in the alloy of at least one additive metal selected from the group consisting of titanium, nickel, chromium, zirconium, and manganese where said alloy contains the tetragonal phase $RE_2TM_{14}B_1$ wherein RE represents the rare earth metals, TM represents the transition metals and B represents boron.

XI. Prosecution Of the Claims In Issue Of the '931 Patent

174. Ser No. 544,728, on which the '931 patent is based and was filed on October 26, 1983, contained thirty two (32) original claims. (CX-19, M 002401-2463).

175. In an amendment dated Sept. 9, 1985, applicant added claims 33-65. (CX-19, M 002514-2522; CX-20, Tab 11).

176. Twice amended claims 38, 51, 52 became independent claims 1, 2 and 3 in

issue respectively. (CX-19, M 002608-2609). Twice amended claims 60, 64, 66, 68, 69 and 70 became independent claim 10, 14, 16, 18, 19 and 20 in issue respectively. (CX-19, M 002610-2615).

177. Applicant in the remarks section of the amendment dated Sept. 9, 1985 and in which claims 33-65 were added (CX-20, Tab 11) argued:

> Claims 5 and 26-32 have been rejected under 35 USC 102 or 103 over Koon 4,402770. Koon is cited as teaching a permanent magnet alloy which may contain Nd and Pr.
>
> Koon relates to compositions which must contain heavy rare earth elements, lanthanum, at least one transition metal, boron and an auxiliary glass former such as phosphorous, silicon, aluminum, arsenic, germanium, indium, antimony, tin, or bismuth. Applicant's compositions do not require lanthanum or such glass formers to obtain better magnetic properties than any taught or suggested by Koon. Moreover, Koon prefers the heavy rare earths and cannot tolerate more than 2 percent neodymium and/or praseodmium in his compositions (Col. 2, lines 46-50).
>
> All claims now in the case except claims 73 and 74 [The Examiner in the Office action dated 5/15/86 (CX-20, Tab 12) assumed applicant was referring to claims 62 and 63] require at least about 6 atomic percent Nd and/or Pr. Claims 73 [62] and [63] require more than 2 percent of these elements. Accordingly, all claims are outside the compositional ranges of Koon and are not anticipated nor obviated by the reference.
>
> Claims 1-6, 8-20 and 26-32 are rejected under 35 USC 103 over any one of Jap. Doc. Nos. 56-47538, 54-76419 or 57-141901.
>
> Claims 40-50 are believed to be in condition for allowance over the Japanese references based on their prosecution in parent application USSN 414,S36.
>
> Jap. '538 (Hitachi) pertains to "intermetallic compounds comprising rare earth metal elements and Co, and particularly pertains to the improvement in Cu-added R_2Co_{17} type permanent magnet alloy" (page 2, par. 1 of translation). These magnets

have a hexagonal crystal structure. Their performance is improved by adding a small amount of copper to promote precipitation hardening.

The subject invention relates to alloys where the predominant magnetically hard constituent is the $RE_2TM_{14}B_1$ phase. This phase has a tetragonal crystal structure which can be readily distinguished from the hexagonal structure of rare earth-cobalt based magnetic alloys. In order to obtain good magnetic properties, the light rare earth elements Nd and/or Pr must be present as well as an amount of iron greater than the amount of cobalt. Boron is required to form this stable phase. Any appreciable amount of copper greatly reduces the alloys' magnetic properties.

The Hitachi reference not only relates to a different family of magnetic materials, but it can only be said to suggest Applicant's compositions by distortion of its overall teachings. The maximum allowable amount of iron which may be present is 35.7% based on the formula

$$R(Co_{1\text{-}x\text{-}y\text{-}alpha\text{-}beta}Fe_xCu_yM_{alpha}M_{beta})_A$$

where A is the maximum of 8.3 and x is the maximum 0.4. In that situation the ratio of Co to Fe is about 1.5:1. There must be substantially more Co than iron. In such composition, the amount of boron would be less than 0.1%. Furthermore, the reference does not require nor even mention that Nd or Pr must be present. The examples are all based on Sm as the rare earth element because Sm and Co form the 2-17 phase.

Applicant's compositions require more iron than cobalt. They are all based on Nd and/or Pr. They require more boron than most of the alloys claimed by Hitachi would allow. Moreover, the reference teaches that adding iron in an amount of more than about 10 percent of the cobalt reduces the intrinsic magnetic coercivity of sintered alloys (translation, page 2, par. 2, lines 14-17). Figure 11 of the subject application shows that increasing the iron content up to about 87% increases coercivity. Hitachi also teaches that adding boron reduces the Curie temperature (trans., page 3, par. 3). Figure 27 of our application shows that adding boron increases Curie temperature. The fact that iron and boron cause different and documented results in the compositions claimed herein and those taught by Hitachi strongly substantiates the material differences between the two different families of magnetic materials.

Jap. '419, also to Hitachi, relates to "highly magnetostrictive materials of the type used for ultrasonic oscillators" (translation, page 2,lines 1-2). Magnetostricters must have very low coercivities so they can rapidly change polarity with little loss in weak reversing field: that is, they are very soft magnets with low coercivities. This is discussed, for example, at page 5, Col. 1 of a booklet put out by Hitachi Magnetics which was also cited by Applicant in the prosecution of USSN 274,070.

All claims herein are drawn to permanent magnets with very high coercivities. Therefore, they are not suggested by the magnetically soft alloys of the '419 reference. Furthermore, while the compositions suggested by the reference can be forced to overlap Applicant's claims. Jap. '419 does not require Nd and/or Pr, at least about 40 atomic percent iron or greater than 0.5% B. None of the examples contains Nd or Pr nor suitable proportions of iron and boron. It would take more than routine experimentation by one skilled in the art to arrive at Applicant's invention based on the teachings of Jap. '419.

Similarly, Jap. '901 to Mitsubishi Seiko recites a broad range of compositions which can be forced to overlap Applicant's. But again, there are thousands of other compositions included in the '901 teaching which do not overlap nor suggest Applicant's. No iron is required and Ti, V, Cr, Cu, Zr, Nb, Mo, Hf,Ta and W are taught to be equally suited. No boron is required and Si, P and C are taught to be equally suited. Any rare earth is acceptable: Nd and/or Pr are not required.

Furthermore, the '901 reference is effective as a reference only one any before the filing of parent application USSN 414,936. It was sworn behind as a reference in that application. It does not teach nor suggest claims 33-39 of this application which recite the $RE_2TM_{14}B_1$ phase and its crystal tetragonal structure and therefore does not obviate these claims. Like the other Japanese references, it relates to the $SmCo_5$ to Sm_2Co_{17} family of magnetic alloys with hexagonal crystal structures. Jap. '901 is not an effective reference to claims 40-50 of the '936 application which antedate it. It does not obviate the compositional claims 51 to 65 for the reasons set forth above.

> The potential double patenting rejection will be addressed by Applicant at such time as notice of allowance of claims in related USSN 414,936 is received.

178. The Examiner in an Office Action dated May 15, 1986 (CX-20, Tab 21) provisionally rejected claims 33 to 65 under 35 U.S.C. 101 as claiming the same invention as that of claims 15, 21, 22, 24 and 26 to 32 of copending application Serial No. 414,936 on which the '058 patent is based.

179. The Examiner in the Office of Action dated May 15, 1986 (CX-20, Tab 12) made the following art rejections:

> Claims 33 to 39, 51, 59 and 62 to 65 are rejected under 35 U.S.C. 103 as being unpatentable over Koon '770.
>
> Koon teaches a permanent magnet alloy containing Fe, B, La and additional rare earths including Nd and Pr (column 2, lines 47 to 50). As claimed applicant's invention does not distinguish over Koon's alloy.
>
> Applicant's arguments filed September 9, 1985 have been fully considered but they are not deemed to be persuasive.
>
> Applicant argues that all claims in the case now require at least about 6 atomic percent Nd and /or Pr except claims 73 to 74 which require more than 2 atomic percent Nb and/or Pr. The Examiner does not agree. Claims 33 to 39, 51 and 59 describe only the "predominant" phase or constituent. Therefore the Nd and/or Pr proportions of the total composition are not clear and do not clearly define over Koon.
>
> It is noted that there is no claim 73 or 74. The Examiner assumes that applicant is referring to claims 62 to 63. These claims read on an Nd and/or Pr content which closely approximate 2 atomic percent, e.g. 2.001 atomic percent and therefore closely approximate Koon's composition. When two compositions closely approximate one another an actual overlap

is not necessary for 103. In re Becket 33 U.S.P.Q. 33.

Claims 64 and 65 are silent with respect to the Nd and/or Pr content.

Koon has not been applied against claims 58, 60 and 61 subject to applicant's interpretation that the claim language "10 to 40 atomic percent of one or more rare earth elements including at least about 6 atomic percent neodymium and/or praseodymium" (claim 58, lines 2 to 4) means that Nd and/or Pr must always be present in the amount of at least 6 atomic percent base on the total composition.

Claims 51, 52, 54 to 59, 61, 64 and 65 are rejected under 35 U.S.C. 103 as being unpatentable over Japanese document No. 56-47538.

The reference teaches a permanent magnet alloy containing, in atomic percent, 0.85 to 35.7% Fe, 4.3 to 86.4% Co, 0.85 to 13.4% B, 0.85 to 13.4 % Hf, 12 to 14.3% rare earth metals, 1.7 to 22.3% Cu and the balance Co. The permanent magnet composition taught by the reference overlaps applicant's claimed alloy and thereby establishes a prima facie case of obviousness. The open claim language "comprising" does not preclude the presence of Hf and Cu taught by the reference. It is noted that claims such as claim 52 clearly encompass Hf and Cu (claim 52, lines 6 to 8).

Applicant's arguments filed September 9, 1985 have been fully considered but they are not deemed to be persuasive.

All of the claims included in this rejection are silent with respect to crystal structure and therefore include the R_2Co_{17} alloys taught by the reference. The Examiner agrees with applicant that the maximum amount of iron that can be present in Hitachi's alloy is 35.7 atomic percent. However, contrary to applicant's arguments such an alloy can contain, in atomic percent, up to 13.4% B and as little as 4.5 percent Co. Each of which is well within the proportions of applicant's claimed alloy. Finally, in view of the lack of any evidence to the contrary applicant's particular choice of Nd and/or Pr as the rare earth component is considered a matter of choice. It is noted that claims 64 and 65 are silent with respect to Nd and/or Pr.

* * *

> Claims 34 to 39, 43, 44, 48, 50 to 56 and 59 to 65 are rejected under 35 U.S.C. 103 as being unpatentable over Kabacoff et al.
>
> Kabacoff et al. teach a magnetic composition consisting of, in atomic percent, 0 to 30% Pr, 56 to 80% Fe and 14 to 20% B. Such a composition overlaps claimed composition and thereby establishes a prima facie case of obviousness.
>
> Claims 40 to 42, 45 to 47 and 49 are allowed subject to applicant's interpretation that these claims are limited to alloys containing at least about 10 atomic percent neodymium and/or praseodymium and at least about 50 atomic percent iron based on the entire composition (see Serial No. 414,936, [application on which '058 patent is based] Paper No. 12, filed June 10, 1985, page 7, first paragraph of applicant's remarks).
>
> Applicant is advised that the Examiner has made a copy of applicant's affidavit filed under 37 C.F.R. 1.131 on June 10, 1985 in parent application Serial No. 414,936 and entered said copy as Paper No. 11 in the instant application.

With the May 15, 1986 Office Action, the Examiner cited Koon et al, "Magnetic Properties of Amorphous and Crystallized $(Fe_{0.82}B_{0.18})_{0.9}$ $Tb_{0.5}La_{0.5}$," App. Phys. Lett. Vo. 39, No. 10, pp. 840-842 Nov. 15, 1981. (CX-20, Tab 13).

180. Applicant, in an amendment dated Sept. 24, 1986 (CX-20, Tab 15) added claims 66-72. As to rejections on art it was argued:

> All claims rejected over Koon '770 have been amended or canceled and rewritten to require at least about 6 atomic percent Nd and/or Pr. This is a substantially higher and patentably distinct amount of these rare earths than the 2 atomic percent maximum allowed by Koon.
>
> All claims herein corresponding to those rejected over Hitachi's Jap. Doc. No. 56-47538 now recite the presence of the $RE_2TM_{14}B_1$ phase. Applicant maintains, however, that only by a strained interpretation of the '538 reference, extensive

experimentation, use of the teachings in this application, and the non-obvious use of Nd and/or Pr could one possibly arrive at Applicant's compositional invention.

Claims 34-39, 43, 44, 48, 50-56, and 59-65 (all without a 10 atomic percent upper limit on boron) are rejected as obvious in view of the article to Kabacoff et al. Other compositional claims have since been more broadly rejected over Kabacoff et al. in related USSN 414 ,936. (Office action dated July 25, 1986). That rejection cites Kabacoff as teaching permanently magnetic crystalline Fe-B-Pr compositions.

The Examiner relies heavily on the introduction of the Kabacoff article where he states the objective of the magnetics community to make permanent magnets based on the rare earth elements and iron.

While most work on ferromagnetic metallic glasses has centered on magnetically soft materials, there is also an interest in the development of glasses containing Fe and rare earths either directly as permanent magnets or as precursors for new crystalline phases with hard magnetic properties. (Emphasis added).

The article then sets forth data obtained in connection with Kabacoff's products of rapidly solidified, magnetically soft, amorphous, Pr-Fe-B alloys. He notes at page 2256, col. 1 that:

> The coercive force at room temperature was too small to be measured on the vibrating sample magnetometer (<5 Oe).

At the end of the discussion section he notes:

> What was surprising about the results was the failure to detect a coercive force using this instrument (the vibrating sample magnetometer). This puts a very conservative upper limit on H_c of 5 Oe.

The article concludes with the statement:

> The values of Hc in crystallized samples of the

present alloys will be presented subsequently.

The Examiner states in the '936 office action:

> Kabacoff et al. disclosure is not limited to magnetically soft amorphous compositions. Instead the Examiner contends that Kabacoff et al. clearly suggest crystalline Fe-B-Pr permanent magnet compositions (see Introduction).

The conclusion on the Examiner's part that Kabacoff teaches Applicant's permanent magnet compositions makes sense only when read in light of Croat's disclosure in the subject application and the '936 parent case.

A reading of the Kabacoff reference without 20:20 hindsight would lead one skilled in the art to conclude that Kabacoff desired, as had all workers in the art, to make permanently magnetic rare earth-iron based compositions. His plan was to do it by making amorphous precursors and annealing them.

In that vein, Kabacoff made amorphous Pr-Fe-B alloys and measured their magnetic properties. He seemed to expect relatively high coercivity (i.e. permanent magnetism) in these materials in view of earlier work by Croat and Koon but was surprised to find his samples had an upper coercivity limit of 5 Oe -- very soft magnets. He crystallized numerous samples of varying composition (i.e., heated them to T_x) and determined that several different crystal phases formed in them.

There is no evidence in the paper that Kabacoff actually made any permanent magnets even though it is very apparent that he (and everyone else) hoped to do so. Therefore, one skilled in the art considering the Kabacoff paper without knowing about the subject invention would have to conclude that Kabacoff did not and could not make permanent RE-Fe magnets. The reference would, therefore, have drawn one skilled in the art away from pursuing the concept of making permanent rare earth-iron magnets made by crystallizing amorphous precursors.

An Affidavit of Lawrence T. Kabacoff under 37 C.F.R. 1.132 is offered herewith in support of the nonobviousness of the rejected claims over the article. The Examiner's rejection is based upon a

> mode or capability of operation attributed to Kabacoff's samples -- i.e., that they were permanently magnetic. The Affidavit clearly rebuts the basis for the Examiner's rejection. Dr. Kabacoff has very candidly and forthrightly sworn that all samples made in connection with the article which were measured for magnetic coercivity were magnetically soft. The Affidavit further shows that Dr. Kabacoff intended to pursue the creation of RE-Fe-B permanent magnets but had not done so as of April 4, 1983. On this date (which is well after the September 3, 1982 filing date of parent case '936), he discovered that George Hadjipanayis had made melt-spun and heat-treated Pr-Fe-B containing alloys which were permanently magnetic. Upon finding that someone else had already accomplished his goal, he did not pursue additional research related to magnetically hardening RE-Fe-B alloys. He also did not follow-up on the suggestion in his paper that values of Hc in crystallized Pr-Fe-B samples would be published.

181. The Examiner, in an Office Action dated Feb. 4, 1987 (CX-20, Tab 18) stated that the affidavit under 37 CFR 1,132 filed September 24, 1986 was sufficient to overcome the rejection of claims 34 to 38, 43, 44, 48, 50 to 56 and 60 to 65 based upon Kabacoff et al. However, in addition to rejections of the claimed subject matter under 35 U.S.C. § 112, claims 40 to 50 and 72 were provisionally rejected under 35 U.S.C. § 101 as claiming the same invention as that of claims 15, 21, 22 24 and 26 to 32 of copending application Serial No. 414,936 on which the '058 patent is based.

182. Applicant, in an amendment dated April 20, 1987 (CX-20, Tab 20) argued:

> Applicant's attorney acknowledges that two issues remain. One issue is the matter of the recitation of boron content in claims 38, 43, 44, 48, 50, 51, 58, 60, 61, 64 and 66-69. The other issue is the matter of a provisional double patenting rejection because copending application Serial No. 414,936 contains the same claims as claims 40-50 herein.

* * *

Dr. Croat discovered that iron-neodymium and iron-praseodymium based compositions could be rapidly solidified to form products having permanent magnet properties. That discovery was disclosed and claimed in his U.S. Patent No. 4,496,395. The subject application describes and claims improved compositions that incorporate boron. The addition of boron to iron-neodymium alloys, for example, provides a substantial increase in magnetic properties such as coercivity, energy product and Curie temperature. In the experience reflected in the many examples presented in the subject application, the preferred addition of boron to iron and neodymium or praseodymium based compositions is such that boron makes up about 0.5 to 10 atomic percent of the total composition. Particularly desirable permanent magnetic properties were observed in such mixtures described in the working examples of this application. However, there is no suggestion in the application and indeed no technical basis for concluding from its teaching that higher boron additions are unsuitable for achieving improvements in magnetic properties in iron-neodymium- praseodymium based compositions. To the contrary, in the brief summary portion of the specification at pages 3 and 4, it is stated with reference to the basic formula $RE_{i-x}(TM_{i-y}By)x$ that the value of x is preferably in the range of about 0.5 to about 0.9 and y is preferably in the range of about 0.01 to about 0.20. Accordingly, in this disclosure of a preferred practice of the invention, the boron content could be at least about 18 atomic percent of the overall basic formula. Page 24, lines 27-32 of the specification teaches that boron additions over 10 atomic percent do not inhibit the essential magnetic phase even though magnetic properties may be diluted. In general, the specification points out benefits of combining boron with iron and neodymium and/or praseodymium. There is no suggestion that boron content in excess of amounts described as preferred so change the magnetic properties of the overall compositions as to be outside the scope of the invention.

Claims 38, 43, 44, 48, 50, 51, 58, 60, 61, 64 and 66-69 are presented in the application to recite the invention in a different form than other claims that recite a boron content range. They require that a magnetically hard alloy composition be formed and that it contain a specified range of rare earth elements and iron and a minimum amount of boron. These claims also require minimum magnetic properties and/or the presence of the essential magnetic phase $RE_2TM_{14}B_1$. In other words, they provide compositional ranges for two of the necessary constituent element types, they provide a minimum amount of the third necessary constituent, boron, and they require that the overall material cooperate to provide certain minimum permanent magnet properties and/or a specific iron-neodymium/praseodymium-boron containing phase. The law does not require applicant's claims to provide a detailed recipe of his permanent magnets. The law requires the claims to distinctly claim the invention. It is respectfully submitted that claims 38, 43, 44, 48, 50, 51, 58, 60, 61, 64 and 66-69 accomplish this requirement and satisfy 35 USC 112.

Claim 71 differs in format from claims that were discussed with the Examiner. This claim specifies a permanent magnet having intrinsic magnetic coercivity of at least about 1,000 Oersteds and comprising at least 90 percent by weight of the phase $RE_2TM_{14}B_1$. Minimums of Nd and/or Pr and Fe are specified. Thus, 90 percent of the content of the magnet is specified as well as its minimum intrinsic coercivity.

As regards the provisional double patenting rejection, applicant's attorney would like to leave that issue until the claims in question have been allowed. Of course, the issue of double patenting can be resolved by retaining the claims in this application and deleting them from Serial No. 414,936 [application on which '058 patent is based] or vice versa. In view of the prospect of an interference involving these claims, applicant's attorney prefers to deal with the matter of prospective double patenting later.

Applicant's attorneys believe that they have brought to the attention of the Examiner all prior art of which they or the applicant are aware having any possible bearing on the patentability of applicant's claims. However, applicant's attorneys also wish to make the Examiner aware of a publication by J. F. Herbst, J. J. Croat, F. E. Pinkerton and W. B. Yelon, "Relationships Between Crystal Structure and Magnetic Properties in $Nd_2Fe_{14}B$," Physical Review B, Vol. 29, No. 7, 1 April 1984. A copy is enclosed. This publication by four co-workers including applicant describes the crystal structure and room temperature moment arrangement of an essential tetragonal rare earth-iron-boron phase constituent of applicant's permanent magnets. The similarity between Figure 1 of this publication and

Figure 54 will be recognized. It is also apparent that several claims in this application include a recitation of the phase determined by these co-workers and reported in this publication.

Applicant's claimed magnets, as described in the many actual working examples included in this application and its parents, were made and tested before this determination of the tetragonal phase was made. This work thus describes a constituent phase of the claimed magnets which had already been invented by Dr. Croat. Material from this publication was added to the application to provide more information concerning the composition of the claimed magnets. This crystal structure is recited in some claims to more clearly define applicant's magnets. However, applicant's attorneys have not viewed Drs. Herbst, Pinkerton and Yelon as co-inventors because they were not involved in the conception and reduction to practice of the claimed magnets. Their contribution was to assist in the description of the magnets after they had been made.

183. The Examiner, in an Office Action dated 8/26/87 (CX-20, Tab 24) allowed claim 62. However claims 38, 51 to 58, 60, 61 and 63 to 71 were rejected under 35 U.S.C. § 112. Thereafter following the filing of a amendment (CX-20, Tab-26), the Examiner in an Office Action dated 12/18/87 allowed claims 61, 62, 64 and 65 although he maintained his 35 U.S.C. § 112 rejection of claims 38, 51 to 58, 60, 63 and 66 to 71.

184. Applicant in a "Supplemental Amendment After Final Rejection In Response To Advisory Mailed 12/18/87" dated February 1, 1988 (CX-20, Tab 28), represented that claims 61, 62, 64 and 65 have been allowed and argued the Examiner's rejection of remaining claims 38, 51 to 58, 60, 63 and 66-71 under 35 U.S.C. § 112.

185. The Examiner in an "Examiner Interview Summary Record" (CX-20, Tab 29) dated March 3, 1988 stated that he had indicated that the application was now in condition for allowance.

186. The Examiner in a "Notice Of Allowability" dated March 7, 1988 (CX-20, Tab 30) with respect to Serial No. 544,728 stated that claims 38, 51 to 58 and 60 to 70 were allowed. A notice of allowance (CX-20, Tab 31) issued on March 7, 1988. The application had been assigned "Patent No. 4,756,775" and "an issue date of July 12, 1988." (CX-20, Tab 33).

187. A Patent Office communication (Paper No. 30), dated July 7, 1988 (CX-20, Tab 34) stated:

> The purpose of this communication is to inform you that application Serial No. 544,738, which has received Patent No. 4,756,775 and an issue date of July 12, 1988, is being withdrawn from issue pursuant to 37 CFR 1.313.
>
> The application is being withdrawn to permit reopening of prosecution. This withdrawal was requested by the Group Director.

188. The Examiner in a "Notice Of Allowability" dated 12/2/88 (CX-20, Tab 40) with respect to Serial No. 544,728 stated that claims 38, 51 to 58 and 60 to 70 were allowed. Notice of Allowance issued on 12/2/88. (CX-20, Tab 41).

189. The Patent Office Board of Patent Interferences in a communication dated 8/11/95 (CX-20, Tab 46) stated that claims 1 thru 11 of the '058 patent and claims 1 thru 20 of the '931 patent were involved in Interference No. 103,182 with applicant Croat the junior party and Norman C. Koon's claims 1 thru 31 and 34 of reissue Serial No. 7/248,217 filed 9/23/88 the senior party. Count 1 of the interference read:

<u>COUNT 1</u>

> A permanent magnet alloy composition comprising, in atomic percent, 6 to 40 percent of at least one rare earth metal, 0.75 to 28.75 percent boron, 50 to

90 percent of at least one transition metal selected from the group consisting of iron and cobalt, 0 to 4.75 percent of at least one element selected from the group consisting of phosphorus, silicon, aluminum, arsenic germanium, indium, antimony, bismuth, and tin and from 0 to less than 20 percent based upon the iron content in the alloy of at least one additive metal selected from the group consisting of titanium, nickel, chromium, zirconium, and manganese where said alloy contains the tetragonal phase $RE_2TM_{14}B_1$ wherein RE represents the rare earth metals, TM represents the transition metals and B represents boron.

XII. Prosecution of the Claims In Issue Of The '368 Patent

190. Serial No. 516,841 filed July 25, 1983 and on which the '368 patent is based, as filed contained forty-eight claims. (CX-28, M 005334-5343). In an Office Aaction dated March 19, 1984, the forty eight claims were rejected as unpatentable over claims 1 to 42 of the applicant's copending application Serial No. 510,234 which is the earliest application on which the '723 patent in issue is based. The Examiner's position was that although the claims are not identical, "they are not patentably distinct from each other because the claims of the instant application (the claims of Serial No. 510,234 do not preclude the presence of Co. Therefore the claims of applicants' two applications overlap)." The Examiner stated that a timely filed terminal disclaimer in compliance with 37 CFR 1.321(b) would overcome the rejection. (CX-28, M 005846-49; CX-6).

191. Claims 49 to 96 were not added to Serial No. 516,841 until the amendment dated November 1, 1984 was filed. (CX-28, M 005926-5942). New claims 97 and 98 were added by an amendment filed November 13, 1985. (CX-28, M 006440-6452). New claims 99, 100 and 101 were added by an amendment filed November 14, 1986. (CX-28, M 006758-6766).

192. Claims 1-6, 8-10, 13-19, 21-24, 27-35 and 37-39 are in issue. Of those claims,

claims 1, 2, 3, 13, 15, 16, 32 and 33 are independent claims. Claim 1 corresponds to twice amended claim 49 (M 006759); claim 2 corresponds to amended claim 52 (M 006442); claim 13 to twice amended claim 67 (M 006760); claims 15 and 16 to twice amended claims 70 and 71 (M0067616763); and claims 32 and 33 to twice amended claims 94 and 95 (M 006764-6765).

193. The Examiner in an Office Action dated May 13, 1985 (CX-29, Tab 15) rejected claims 49 to 96 under 35 U.S.C. § 103 as being unpatentable over Japanese Kokai No. 56-47538 on the ground that the Japanese Kokai teaches a permanent magnetic material containing in atomic percent, 0.09 to 13.4 percent boron, 12 to 14.3 percent of at least one rare earth, iron, cobalt and various other elements which composition overlaps applicants' claimed composition and thereby establishes a prima facie case of obviousness and that in view of said overlap the composition of the reference would be expected to have the same structure and properties as applicants' claimed composition.

194. The Examiner in the Office Action dated May 13, 1985 (CX-29, Tab 15) also rejected claims 49 to 96 under 35 U.S.C. 103 as being unpatentable over Japanese Kokai No. 52-50598 on the ground that the reference teaches a rare earth cobalt intermetallic compound comprising in atomic percent 13.3 to 17.6 percent rare earth, 70.2 to 75.2 percent of the sum of Cobalt, Iron, and Nickel and 11.5 to 12.2 percent of at least one of Ta, V, B, Mn, Cr, Zr, Ti and Nb which composition overlaps applicants' claimed composition and therefore establishes a prima facie case of obviousness. The Examiner further rejected claim 49 to 96 under the doctrine of obviousness-type double patenting as being unpatentable over the claims of applicants' copending applications Serial No. 532,473; 532,472 and 510,234. On the

ground that the claimed compositions of all those applications overlap. Aerial No. 519, 234 is the original application on which the '723 patent in issue is based.

195. The Examiner in the May 13, 1985 Office Action (CX-29, Tab 15) further rejected claims 49 to 96 under 35 U.S.C. § 103 as being unpatentable over Japanese Kokai No. 57-141901 on the ground that the reference teaches a permanent magnet powder consisting essentially of, in atomic percent, 10 to 65 percent of one or more rare earths, 12.3 to 90 percent of a transition metal among which is disclosed iron and cobalt and 0 to 31.5 percent of metalloial among which is disclosed boron and that such a composition overlaps applicants' and therefore establishes a prima facie case of obviousness.

196. Applicants in their amendment filed on November 13, 1985 (CX-29, Tab 19) and which included independent claim 2 in issue (amended claim 52) argued against the art cited by the Examiner in his Office Action dated May 13, 1985. Thus it was argued (footnotes omitted):

> As explained at the interview, each of the recitations in the claims is important in defining the present invention. More particularly, by specifically defining the material as being anisotropic, the material is distinguishable from known isotropic materials made by rapid quenching techniques. The distinct nature between the anisotropic material of the present invention and isotropic materials made by rapid quenching techniques is recognized in the article by General Motors Researcher, R.W. Lee, entitled "Hot-Pressed Neodymium-Iron-Boron Magnets" which was accepted for publication on February 4, 1985 and actually published on April 15, 1985. This recent article (which of course is not prior art), states:
>
>> "There are essentially two distinct processes by which fully dense, aligned magnets have been produced from Nd-Fe-B alloys: one is to rapidly quench from the melt to a near amorphous, fine

grained form and subsequently to densify and align by hot pressing. The other is to grind the alloy into a fine powder, align the powder in a magnetic field during cold pressing and sintered to near full density. ... The challenge has been to produce fully dense, anisotropic (aligned) magnets from the [rapidly quenched] ribbons." (Emphasis added)

The article then goes on to explain how a new method has been developed which allegedly obtains fully dense, well aligned neodymium-iron-boron magnets from rapidly quenched material. Therefore, as even recognized by scientists at General Motor Research Laboratories there is a significant difference between anisotropic magnets and isotropic magnets prepared by rapidly quenching a molten alloy. Additionally, the article makes it clear that there was no simple process in existence at the time the present invention was made by which an anisotropic magnet could be made from a rapidly quenched material.

Also discussed at the interview were the substantial distinctions between the presently claimed invention and samarium-cobalt-type magnets. In particular, as is well known in the art, the samarium cobalt compounds have an essentially hexagonal or rhombohedral structure whereas the materials of the present invention have a substantially tetragonal crystal structure. In the crystal structure of a samarium cobalt-type magnet, samarium functions quite differently from neodymium and praseodymium. Specifically, as shown in Table I of the Greedan et al article, the easy direction of magnetization for a R_2Co_{17} compound wherein R is samarium is the C-axis. However, for both neodymium and praseodymium, the easy direction of magnetization is in the planar direction. This generally means that that the use of neodymium and/or praseodymium in this type of magnet is contraindicated since a planar direction of magnetization indicates that poor magnetic properties will be obtained.

Graphically demonstrating the fact that the presence of neodymium and praseodymium in a samarium cobalt magnet adversely affects the magnetic properties of the magnet is the information which is set forth in the article by J.C. Koon published in September, 1984. As stated on page 1594:

"In Nd and Pr substituted Sm $(Co_{62}Fe28Cu_{08}Zr._{02})_{7.4}$, as shown in Fig. 2, the coercive force decreased more rapidly than the mischmetal alloy described above. Unexpectedly, B_R did not increase with these substitutions and, instead, even started to drop at about more than 20% substitutions. This drop of BR seems to be more pronounced for Nd than for Pr substituted magnets. The maximum energy product stayed nearly as high as Sm $(Co, Fe,Cu,Zr)_{7.4}$ magnets at up to about 20% substitutions by Nd but then decreased above this level. The decrease in $(BH)_{max}$ is also observed in the Pr alloy but at an even higher rate due to its higher loss of loop squareness."

The foregoing information reflects the current understanding in the art that the presence of neodymium and/or praseodymium in samarium cobalt-type magnets will adversely affect the magnetic properties thereof. The converse is also true. That is, if samarium is substituted for the neodymium and/or praseodymium required in the magnetic materials of the present invention, the resulting magnetic proper ties will rapidly decrease. Hence, as clearly evidenced by the graph of Exhibit 1, not only is neodymium and praseodymium not an equivalent of samarium in samarium cobalt-type magnets, but samarium is not the equivalent of neodymium and/or praseodymium in the magnetic materials of the present invention.

The presence of a substantial amount of copper in the material described in the Koo article reflects a further important distinction between that type of magnet and the magnets of the present invention. More precisely, the Sm_2Co_{17}-type magnets are commonly known as a "pinning" type or "precipitation" type magnet good magnetic properties. These sites are created by the presence of a precipitating agent such as copper. The pinning or precipitation type magnet is different from the magnets of the present invention which may be referred to as a "nucleation" type magnet. In contrast to Sm_2C0_{17}-type magnets, the presence of a substantial amount of copper in the magnets of the present invention would adversely affect the magnetic properties thereof (see for example, the effect of copper on magnetic remanence shown in Fig. 13). In this regard, the upper limits described on page 19 of the specification were established with a maximum energy product of 4 MGOe (see lines 22-25). Since all the claims of record recite a maximum energy product of at least 10 MGOe, it is apparent that much less copper than 3.5 atomic % can be present.

With respect to the $SmCo_5$-type magnet, a fundamental distinction exists. That is, while iron is essential in the present invention, iron is not required in the $SmCo_5$-type magnet. In fact, iron cannot be used in place of cobalt in this type of magnet since it does not form a corresponding $SmFe_5$ compound. This may be understood [sic] page 161 of the Handbook of the Physics and Chemistry of Rare Earth (Volume 2) which states:

> "The main group of compounds with the $CaCu_5$ structure and non-zero B-moment is the RCo_5. <u>RFe_5 compounds generally do not exist</u>. This may be due, to some extent, to the effect of conduction electron concentration which is lower in any hypothetical RFe_5 compared with RCo_5. The exception is $ThFe_5$ which does exist due to the fact that Th is quadravalent." (Emphasis added)

The foregoing conclusion is further supported from the excerpt from "Scientific Bulletin", Department of the Navy, Office of Naval Research (Tokyo, 1980), Vol. 5, No. 4, page 47-56 (copy provided in Appendix C) which states (at page 55):

> "Mr. H. Yamamoto is working with (Mischmetal) Co_5 magnets trying to optimize the substitution of Fe for Co and Sm for MM. He finds that the coercivity critically depends upon the milling and sintering procedures. $SmFe_5$ and $MMFe_5$ have not been observed; only the 2-7 and-17 phases seem to form."

Thus, not only would it not be obvious to use iron in place of cobalt for this type of magnet, it would not be technically possible to add more than 1 or 2% iron to such a compound without significantly affecting the magnetic properties.

Yet further evidence of the distinctive natures of the samarium cobalt-type magnets and the magnetic materials of the present invention exists with respect to the function of boron. As is apparent to those knowledgeable with samarium cobalt-type magnets, a substantial amount of boron is not required to obtain good magnetic properties. In fact, as may be seen from applicants' Declaration Under 37 C.F.R. Sl.132 that was provided in Appendix E of the Amendment filed on October 25, 1984, increasing amounts of boron in a Sm_2C0_{17}-type magnet result in a rapid decrease in intrinsic coercivity which, of course, would mean a decrease in the maximum energy product. Hence, one of ordinary skill in the art would not add any significant amount of boron to a samarium cobalt magnet since to do so would destroy the very magnetic properties which one seeks by using a samarium cobalt magnet.

Quite to the contrary, boron is essential in the magnetic material of the present invention since without this element, acceptable magnetic properties cannot be obtained. This point is graphically demonstrated by the information set forth in Table 1 on page 25 of the specification. As set forth therein, a composition which has 65 atomic percent iron, 20 atomic percent cobalt and 15 atomic percent neodymium (i.e., in the absence of boron) has a zero intrinsic coercivity, a zero magnetic remanence and a zero maximum energy product. This may be constrasted with a composition wherein 8 atomic percent of boron is substituted for 8 atomic percent of the iron. In this composition, the intrinsic coercivity is 8.8 kOe, the magnetic remanence is 12.0kG and the maximum energy product is 33.1 MGOe. This latter Example also demonstrates a further important distinguishing feature of the present invention. That is, without the presence of expensive and scarce samarium and without using rapid quenching techniques, the permanent magnets of the present invention are able to obtain levels of magnetic properties which have heretofore never been reached.

With regard to the presence of cobalt, it should be clear to those of ordinary skill in the art that this element performs an entirely different function in the magnets of the present invention than in samarium cobalt-type magnets. More specifically, as may be seen from Figure 1 of the present application, the presence of increasing amounts of cobalt causes the Curie temperature of the resulting magnet to increase which means that the magnet can be used in higher temperature environments. It is also important to appreciate, however, that the presence of cobalt is not essential to obtaining excellent magnetic properties. This is in significant contrast to samarium cobalt-type magnets wherein cobalt is critical to obtaining the magnetic properties, as was discussed above.

With a full understanding of the significant differences between the presently claimed invention and known magnetic materials based on rapidly quenched alloys or samarium cobalt-type magnets, applicants respectfully submit that the claims of record clearly and distinctly define the present invention in a manner which is patentable over the cited prior art as will be discussed in detail hereinafter.

Japanese Kokai 56-47538 relates to a R_2Co_{17}-type permanent magnet alloy which has a composition expressed by the formula

$$R(CO_{1-x-y-a-B})\ Fe_xCu_yMaM'B)A$$

wherein R is one or a combination of two or more rare earth elements including mainly samarium and/or cerium, M is hafnium and M' is boron.

As should be apparent to those of ordinary skill in the art, particularly in view of the discussion set forth above, the fact that the Japanese Kokai specifically states that the magnetic alloy is a "Cu-added R_2Co_{17}-type permanent magnet" should dismiss this reference from consideration. Indeed, the closer one examines the reference the more inevitable this conclusion becomes. In particular, the Kokai makes absolutely no mention of either neodymium or praseodymium and, in light of the fact that it is known that these two elements adversely affect the magnetic properties of this type of samarium cobalt magnet, it certainly would not be obvious to one of ordinary skill in the art to use neodymium and/or praseodymium in an amount of at least 50% of the total amount of rare earth present as required by the claims.

The Japanese Kokai is further deficient by specifically requiring significant amounts of copper in order to obtain the pinning points for this type of permanent magnet (see page 4 of the verified translation). Additionally, although the broad range for boron overlaps that set forth in the claims of record, the examples of the Japanese Kokai use amounts of boron which are far less than that specified in any of the claims of the present application. Furthermore, applicants' Declaration in Appendix E of the previously filed Amendment shows that the magnetic properties of the described samarium cobalt magnetic are significantly degraded to a coercivity below 1 kOe when more than about 2 atomic percent boron is present.

Even if one were to ignore the completely different nature of the described R_2Co_{17}-type permanent magnet and the presently claimed invention and ignore the fact that the Japanese Kokai does not disclose or suggest neodymium and/or praseodymium in an amount constituting at least half of the rare earth element present and ignore that significant amounts of copper are required in the disclosed type of magnets and lead to adverse results in the magnets of the present invention and ignore that small amounts of boron are actually being taught (i.e., less than the lower level claimed) and ignore that the R_2C0_{17}-type system has a hexagonal rather than a tetragonal crystal structure, one would still not arrive at the presently claimed invention since the maximum amount of iron permitted in the disclosed composition is 35.7 atomic percent. This amount is outside the range of iron defined in the claims of record. Moreover, since the reference specifically indicates that the coercive force of the magnet decreases with increasing iron, one would certainly not attempt to go beyond this disclosed upper limit....

Since the Japanese Kokai explicitly indicates that the magnetic properties will decrease with increasing iron content in the described samarium cobalt-type magnet, ... the claimed range is not obvious from this reference. Hence, even if one were to pick and choose within the disclosure of the Japanese Kokai based on applicants' own specification (which is clearly <u>not</u> proper), one would still not arrive at the presently claimed invention and it logically follows that this reference cannot be used to reject any of the claims of record.

Japanese Kokai 52-50598 describes a rare earth-cobalt magnet obtained by compacting a powder of an intermetallic compound comprising 32-42 weight percent of rare earth elements and 58-68 weight percent of the sum of cobalt, iron and nickel to which at least one of tantalum, vanadium, boron, manganese, chromium, zirconium, titanium and niobium is added in an amount of no more than 2.0 weight percent.

The rare earth-cobalt magnet described in the Japanese Kokai is totally different from the invention set forth in the claims of record. The disclosed rare earth-cobalt magnet is of the RCo_5-type which is of course a totally different system. As pointed out above, it is known that iron cannot be substituted in this type of magnet to any great amount and this is reflected in the fact that no example has more than 1 weight % of iron in it despite the obvious desirability of using less expensive iron for the relatively expensive and scarce cobalt. In this regard, the clear recognition in the art that iron cannot be substituted for cobalt in any significant amount in this type of magnet coupled with the use of only 1% iron directly controverts the Examiner's argument that the Kokai "teaches" a composition within the claims. Of course, as has been repeatedly stressed, composition is only one aspect of the present invention and it is respectfully pointed out that the reference does not in any way suggest the other important aspects of the invention. Thus, in no way can this reference be construed as meeting the recitations of each of the independent claims and especially the recitation of at least 37 atomic percent iron (if the maximum amount of cobalt is present).

The Japanese Kokai is further deficient by indicating that the eight possible additives are optional and for completely failing to recognize the importance of boron in the context of applicants' invention. Indeed, as pointed out above, it is well known in the art that boron is not necessarily required to obtain good magnetic proper ties in samarium cobalt-type magnets and will actually adversely affect the magnetic properties thereof. This is in complete contrast to the present invention wherein boron is essential to obtaining good magnetic properties.

Even if one looks at the closest composition which is the fourth sample set forth in Table 1 of the Japanese Kokai, such a composition is deficient with respect to both the amount of boron (which is totally absent) and the amount of iron which is only one weight percent (which is consistent with the recognition that RFe5 compounds do not exist). Moreover, as was demonstrated in the Declaration of Appendix F of the previously filed Amendment, applicants have attempted to repeat this composition and have found that the described sintering temperature resulted in a complete melting of the initial ingot. When the sintering temperature was lowered and the resulting specimen was crushed and measured for magnetic properties, properties far below those set forth in the Table were obtained. Thus, this evidence as well as the complete failure of the Japanese Kokai to disclose or in anyway suggest the presently claimed invention leads to the proper conclusion that this reference cannot in any way support a rejection under 35 U.S.C. 103.

Japanese Kokai 57-141901 also cannot be used in any way to reject the presently claimed invention. It will be initially noted that the Japanese Kokai has a publication date of September 2, 1982. This date is subsequent to the first priority date of the present application of August 21, 1982 and therefore the Japanese Kokai cannot be used to reject any of the claims supported by the priority document.

Even assuming that the Japanese Kokai could be considered "prior art", it still would neither disclose nor suggest the presently invention. The Japanese Kokai relates to permanent magnet powders obtained by heat treating an amorphous alloy in the presence or absence of a magnetic field, the alloy being expressed by the general formula:

$$(T_{1-x}M_x)_zR_{1-z}$$

wherein x is greater than or equal to 0 and less than or equal to 0.35 and z is greater than or equal to 0.35 and less than or equal to 0.90, T is one or more transition metals, M is one or more metalloids selected from boron, silicon, phosphorus and carbon and R is one or more rare earth elements.

The amorphous alloy disclosed in the Japanese Kokai is completely foreign to the magnetic materials defined in the claims of record. As has been repeatedly been pointed out, boron is essential to the presently claimed invention and this element yields results which are not obtained by silicon, phosphorus and carbon. The Japanese Kokai explicitly indicates that zero percent metalloid may be present and does not in any way appreciate the importance of boron over the other elements. Indeed, from page 4 of the verified translation, it may be seen that silicon is the preferred metalloid element.

The Japanese Kokai is also deficient by failing to appreciate the importance of neodymium and praseodymium. To the extent that neodymium or praseodymium are used in the Examples, none of such Examples have the required amounts of iron and either of the two required rare earth elements. Moreover, to the extent that the maximum energy products are set forth for any of the exemplified alloys (see Examples 4 and 5) the reported values are far less than the minimum values set forth in the claims of record. Therefore, even if the Japanese Kokai could be considered to be "prior art", it still would not disclose or in any way suggest the presently claimed invention and could not be properly used to support a rejection of any of the claims of record.

197. The Examiner in an Office Action dated May 14, 1986 (CX-29, Tab 22) and responsive to communications filed on November 13, 1985 and January 10, 1986 stated that claims 49, 50, 52 to 56, 60 to 68, 70 to 74, 78 to 84, 87 to 89 and 91 to 98 were pending in the application and rejected those claims under the doctrine of obviousness-type double patenting as being unpatentable over the claims of copending applications Serial No. 567,008 No. 532,472, No. 567,640, No. 532,473, and No. 510,234. The Examiner concluded that the claims were not patentably distinct from each other because the rare earth, iron and boron proportions of all said applications overlap; that in the applications claiming cobalt and "M" "M" refers to certain elements set out in the specification and claims) the amount of said Co and "M" reads on the next to zero percent, i.e. impurity levels of cobalt and "M" and therefore do not distinguish over claims which are silent regarding "M" and/or Co; and that the preparation of an isotropic versus anisotropic permanent magnet is well within the skill of the routineer in the art. The Examiner did state that the rejection can be obviated by the filing of terminal disclaimer(s) so that "they all issue the same day." Other than this rejection the Examiner made no rejection on any prior art and further dropped the rejections made on prior art in the May 13, 1985 office action.

198. The Examiner in the Office Action dated May 14, 1986 (CX-29, Tab 22) advised the applicants that for the purpose of perfecting their foreign priority date regarding Japanese Application No. 57-145072, filed in Japan on August 21, 1982, the Examiner had entered into the file as Paper No. 20, a copy of the verified translation of said document from Serial No. 510,234.

199. Applicants in an amendment dated November 14, 1986 (CX-29, Tab 24) presented, as the claims appears in the '368 patent, independent claim 1 (twice amended claim 49), independent claim 3 (twice amended claim 53), independent claim 13 (twice amended claim 67), independent claim 15 (twice amended claim 70), independent claim 16 (amended claim 71), independent claim 32 (twice amended claim 95) and independent claim 33 (twice amended claim 96). In the remarks section it was stated (footnotes omitted):

> By the present Amendment the claims have been amended to meet each of the rejections based on 35 U.S.C. §112 set forth in the Official Action. The amendments to the claims are substantially consistent with those which have been made in the Amendment filed on July 30, 1986 in application Serial No. 510,234 and are believed sufficient to obviate all of the rejections pursuant to the understanding reached with the Examiner noted in the Examiner Interview Summary Record in application Serial No. 510,234. This understanding has been confirmed in the recently received Official Action in application Serial No. 510,234 wherein all of the §112 rejections have been withdrawn.
>
> Turning to the specific grounds of rejection set forth in the Official Action, it is respectfully submitted that the former claims properly defined the amounts of the various elements and that the rejection based on the argument that a certain percentage of the material is indeterminate is improper. This is especially true since there are numerous U.S. patents which have used the language set forth in the former claims and the fact that atomic percentages, as used in the claims of the present application, are based on a total of 100 atomic percent. Therefore, it is totally

incorrect to simply add up the recited minimum value of each component and, since the total number must be less than 100%, conclude that the claim is indefinite.

Although applicants firmly believe that the former language used in the claims was and is in full compliance with the provisions of 35 U.S.C. §112, applicants have amended the claims such that the phrase "the balance being" has been used prior to the recited amount of iron. This language has the same meaning explained in the aforementioned Amendment in Application Serial No. 510,234 and is understood to obviate the rejection for the same reasons.

Claims 97 has been revised to define the percentage of silicon more clearly. The claim now resembles claims 61 and 62 which have previously been found acceptable by the Examiner.

The term "Fe-Co-B-R type ferromagnetic compound" has been revised to define this aspect of applicants' invention with greater particularity. The new terminology is in accordance with the Examiner's comment in the Examiner Interview Summary Record in Application Serial No. 510,234 that the phrase "Fe-B-R type ferromagnetic compound having a substantially tetragonal crystal structure" would be acceptable if the word "type" or "substantially" was deleted. This suggestion has been followed by the present amendment. It should be further considered that the term "type" is used throughout the specification and is well accepted in the art. Thus, for example, of the literature which has previously been provided to the Examiner for consideration, the article by Lee in the March 1981, Journal of Applied Physics in entitled "the Future of Rare Earth-Transition Metal Magnets of type RE_2TM_{17}" (emphasis added). Similarly, the September 1977, IEEE Transactions on Magnetics Publication Authored by Ojima et al, is entitled "Magnetic Properties of a New Type of Rare-Earth Cobalt Magnets" and the first sentence of the introduction states:

> "It is well known that Sm_2 (Co, Cu, Fe) $_{17}$ type permanent magnetic alloys..." (emphasis added).

Should the Examiner wish, further illustrations of the use of the term "type" in connection with permanent magnets will be provided. Thus, consistent with the terminology used in the art and the apparent suggestion by the Examiner, this rejection should also be obviated. Additionally, the term "Fe-Co-B-R" has been replaced with the term "(Fe, Co)-B-R" in order to indicate cobalt substitution for iron in accordance with common usage in the art.

The term "capable of" in reference to the defined level of maximum energy product in certain of the claims has been deleted and the term "upon sintering" has been added. The new term is well accepted in the art, as can be readily be determined by referring to any metals handbook or technical dictionary, and is discussed and exemplified on pages 20-23 of the present application. Thus, those of ordinary skill in the art would have no difficulty in understanding this term. Accordingly, this rejection should likewise be obviated.

As to the remaining rejection under 35 U.S.C. §112, the term "using" while believed to be clear, has nonetheless been replaced so that one of ordinary skill in the art will have absolutely no difficulty understanding the scope of the claims, particularly when read in light of the specification.

With respect to the provisional double patenting rejection, applicants respectfully point out that none of the cited applications which the Examiner has relied on has matured into a patent and that the mere fact that there may be some overlap between the proportions of certain constituents is essentially irrelevant in assessing the presence of "obvious-type double patenting".

* * *

It is therefore apparent that a double patenting rejection is not proper until one of the cited applications actually issues as a patent. Furthermore, the mere fact that some of the ranges may overlap is not sufficient in and of itself to maintain a "double patenting rejection." Additionally, the Examiner certainly cannot rely on the <u>combined</u> scope of the claims of the application cited by the Examiner. This would clearly be treating the cited applications as "prior art" and would be contrary to the holding in the <u>Kaplan</u> decision.

With regard to the first filed of the cited U.S. patent applications,

> namely application Serial No. 510,234, none of the claims in that application recites the presence of cobalt which is specifically recited in each and every claim of the present application. Thus, upon reading the claims of application Serial No. 510,234, it would not be obvious to those of ordinary skill in the art to include cobalt as replacement for iron with the attendant claimed increase in Curie temperature. Once again, it is respectfully pointed out that the mere fact that the claims of one application may dominate another is insufficient by itself to promulgate a double patenting rejection. However, if the Examiner intends to maintain this rejection, applicants respectfully request that all applicants be allowed together or that Application Serial No. 510,234 be first allowed and the rejection then presented. It is only in this way that applicants will be able to determine whether an extension of the patent term will be obtained on an obvious variation of the first claimed invention.
>
> With regard to application Serial Nos. 567,008 and 567,640, applicants respectfully point out that the claims of these applications are specifically directed to isotropic permanent magnets. This is in significant contrast to the claims in the present application, which all require anisotropy. Hence, any type of double patent rejection is totally inapposite for these applications.

200. The Examiner in an Office Action dated May 28, 1987 (CX-29, Tab 30) provisionally rejected claims 49, 52 to 56, 61 to 67, 70 to 74, 78 to 84 and 91 to 101 under the doctrine of obviousness-type double patenting as being unpatentable over claims of copending application serial No. 567,008, No. 532,472, No. 532,473, No. 567,640 and No. 510,234.

201. The Examiner in an Office Action (CX-29, Tab 35) dated October 22, 1987 provisionally rejected claims 49, 52 to 56, 60 to 67, 70 to 74, 78 to 84, 87 to 89 and 91 to 101 under the "judicially" created doctrine of obviousness-type double patenting as being unpatentable over claims of copending application serial nos. 567,008 and 532,472. The

Examiner stated that a terminal disclaimer filed August 13, 1987 is silent with respect to Serial No. 567,008 and 532,472; that it must be established that the instant invention and that if Serial No. 532,472 were commonly owned at the time they were made before a terminal disclaimer would be effective to obviate a double patenting rejection; and that a terminal disclaimer must be filed in each of the involved applications.

202. Applicants on August 13, 1987 and January 4, 1988 filed terminal disclaimers disclaiming the terminal part of any patent extending beyond July 22, 2003. (CX-29, Tabs 42 and 45). Thereafter in a "Notice Of Allowability" (CX-29, Tab 48) the Examiner allowed claims 49, 52-56, 60-67, 70 to 74, 78-84, 87-89 and 91-101.

XIII. Prosecution Of The Claims In Issue Of the '723 Patent

203. Abandoned Serial No. 510,234 filed July 1, 1983 and on which the '723 patent is based contained forty-two (42) original claims. (CX-25, M 003492-3500).

204. On February 10, 1987 applicant filed a request form for file wrapper continuing application under 37 C.F.R. §1.62 of prior application Ser. No. 510,234 filed July 1, 1983. With that request was an amendment filed under 37 C.F.R. §116 which responded to the Office Action dated November 10, 1986 in Ser No. 510,234 and which was designated with the Serial No. 013,165 which was a continuation of Serial No. 510,234. (CX-25, M 003793-003795).

205. In issue are independent claims 1-3, 12, 13, 14, 24, 29 and 30. Claim 1 in issue resulted from twice amended claim 43 (CX-25, M 003699), claim 2 in issue from amended claim 46 (CX-25, M 003640), claim 3 in issue from amended claim 47 (CX-25, M 003640), claim 12 in issue from twice amended claim 56 (CX-25, M 003700), claim 13 in

issue from amended claim 61 (CX-25, M 003642-43), claims 14 in issue from amended claim 62 (CX-25, M 0036443), claim 29 resulted from twice amended claim 83 (CX-25, M 003701, 3705), and claim 30 from twice amended claim 84. (CX-25, M 003705).

206. Applicants in an amendment filed October 25, 1984 in Serial No. 510,234 (CX-26, Tab 10) canceled original claims 1 to 42 and added claims 43-84. In the Remarks portion of the amendment it was argued:

> Before addressing the specific prior art rejections set forth in the Official Action [of May 30, 1984] applicants believe that it is worthwhile to review the background and important aspects of the present invention. As fully explained in the specification, one aspect of the present invention relates to permanent magnets which exhibit extraordinary magnetic properties including a maximum energy product which can range up to 35 MGOe or more. A magnet possessing such a high level of maximum energy product is so powerful that one cubic centimeter can lift a weight of 4.5 kilograms. Practically speaking, any equipment requiring a bulk permanent magnet in order to obtain the required magnetic filed can be greatly reduced in size while achieving the same results if a permanent magnet of the present invention is substituted.
>
> Indicative of the excellent magnetic properties possessed by the permanent magnets of the present invention is that they display a hysteresis loop with good loop squareness.
>
> In other words, if one examines a typical demagnetization curve such as shown in Figure 2, one can plainly see that the permanent magnets of the present invention possess a high saturation magnetization (i.e., the maximum intrinsic magnetization possible in a material), a high residual magnetization (i.e., the point on the demagnetization curve when the magnetizing field H is zero) and a high intrinsic coercivity (i.e., the intersection of the demagnetization curve and the abscissa representing the magnetization field H). Obtaining good loop squareness is important in achieving a high maximum energy product since some magnetic materials (e.g., rapidly quenched alloys) exhibits a high saturation magnetization and a relatively high intrinsic

coercivity, but have a much lower residual magnetization and therefore possess a much lower maximum energy product.

In order to achieve the noted advantageous results in accordance with various aspects of the present invention, it is important that certain compositional and microstructural requirements be met. In particular, as set forth in each and every independent claim of record, the composition must consist essentially of, by atomic percent, 12-24 percent R, 4-24 percent boron and the balance being iron with impurities. The term "R" is at least one of a defined group of rare earth elements. As disclosed on pages 16 and 17 of the specification and as illustrated in various examples, at least 50 percent of R is preferably comprised of the sum of neodymium and praseodymium. This is particularly true when R includes at least one of samarium, yttrium, lanthanum, cerium and gadolinium.

With respect to the claimed term "consisting essentially of", there is excluded types and amounts of impurities and/or additional alloying elements which substantially adversely affect the beneficial results obtained by the present invention. General guidelines for such impurities and additional elements are set forth on page 17 and pages 38-49.

Equally as important as the compositional requirements are the microstructural requirements. That is, by preparing a composition with the required amounts of the defined constitutents, one can obtain a substantially tetragonal crystal structure which is necessary in order to obtain the described advantageous magnetic properties. However, the presence of a substantially tetragonal crystal structure by itself will not yield the extremely high levels of magnetic properties discussed previously. That is, the magnetic substance must also be magnetically <u>anisotropic</u>. As described in the specification, this may typically be obtained, for example, by first forming an ingot of the appropriate composition having a crystal grain size as a normal crystalline alloy which is preferably a few microns or more. The ingot is thereafter pulvrized into particles of the single magnetic domain type which means that the tetragonal crystal structure within each particle is substantially uniformly aligned in one direction. Thereafter, the powder is subjected to orientation in a magnetic field and compacting such that the individual particles rotate so that they are aligned in the magnetic field and are maintained in place. This material is then sintered (e.g., in argon at 1,000-1,200°C for one hour).

The anisotropic magnetic properties possessed by the presently claimed invention is in sharp contrast to those magnetic materials which are prepared by rapid quenching into amorphous or finely crystalline form. In either of these latter cases, single magnetic domain particles can not be obtained through pulverization of such materials due to too fine a crystal grain size and treatment with a magnetic filed would not serve to substantially align the particles since any such fine crystals would be randomly directed in each particle. Thus, such materials are commonly referred to in the art as possessing <u>isotropic</u> magnetic properties.

The defined composition in the absence of substantial amounts of impurities or additional elements as discussed above is also relevant with regard to the grain arrangement. Specifically, in the present invention, the grains containing the substantially tetragonal crystal are surrounded with a nonmagnetic rare earth-rich phase which, upon sintering, melts and flows between the grains thereby etching and cleaning the grain boundaries. The presence of the nonmagnetic boundary phase provides an ideal single domain grain arrangement in the sintered alloy. This is important since reversal of magnetization is believed to start at grain boundary irregularities, such as physical defects or the presence of impurities, and the occurrence of a substantial number of such irregularities causes deterioration of the magnetic properties. By the same token, almost all impurities and additional elements are believed to collect at the grain boundaries thereby creating potential points at which reversal of magnetization can also occur.

With the foregoing background in mind, applicants respectfully submit that the claims now of record clearly and distinctly define the present invention in a manner which is patentable over the the prior art cited by the Examiner in the Official Action and the prior art included in the Information Disclosure Statement which has concurrently been filed herewith. For example, claim 43, like all of claims 43-82, requires the presence of <u>anistoropic</u> magnetic properties. Claim 43 further requires that the magnetic material has an intrinsic coercitiy of at least 1 Koe and consists essentially of the defined amounts of the rare earth elements (with at least 50% of the rare elements being comprised of the sum of neodymium and praseodymium), boron and iron with impurities. The claim further specifies that at least 50 vol. % of the entire material is occupied by an iron-boron-rare earth element ferromagnetic compound or compounds having a substantially tetrogonal crystal structure.

With respect to the cited prior art, applicants argued (footnotes omitted)

> Analyzing the prior art in the order in which it was relied on in the Official Action, Japanese Patent Kokai Publication (hereinafter referred to as Japanese Kokai) No. 55-113304 describes magnetic heads which are made from amorphous alloys having high permeability. As set forth on page 3 of the translation, the alloys are composed of at least one of phosphorus, carbon and boron with the proviso that when two or more elements are used, the combined amount thereof is 7-35 atomic percent. The balance of the alloy is at least one of cobalt and iron. The alloys may also contain (i) no more than 50% nickel, (ii) no more than 25% silicon, (iii) no more than 15% of at least one of chromium and manganese, (iv) no more than 15% of at least one of a defined group of additional elements, and (v) no more than 5% of at least one rare earth element selected from the group consisting of praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, drysprosium, and holmium provided that the total amount of the additional materials is not more than 50%.
>
> As should be apparent to those of ordinary skill in the art, Japanese Kokai 55-113304 has little with the presently claimed invention. As explicitly stated in the Kokai (such as at page 4 of the translation), the alloys are amorphous which are typically prepared by rapid quenching of molten metal onto a quenching surface such as the surface of a rotary drum. Such alloys have isotropic magnetic properties to which the present invention pertains.
>
> While those of ordinary skill in the art will appreciate that the stated distinction between isotropic and anisotropic magnetic properties should be sufficient to patentably distinguish the presently claimed invention over the cited Kokai, there are additional significant reasons why this reference cannot be used to negate the patentability of the presently claimed invention. In particular, the presence of phosphours, carbon and/or boron in

the disclosed alloys are used as a glass former which facilitates preparation of the amorphous state. Such function is, of course, foreign to the presently claimed invention since the amorphous state is certainly not being sought. Moreover, since phosphorus, carbon and boron can not be substituted for one another in the present invention, there is nothing in the Kokai which would lead those of ordinary skill in the art exclusively to boron.

A further significant distinction relates to the presence of rare earth elements. Each of the independent claims of record require the total amount of rare earth element to be the range of from 12 to 24 atomic percent. This is totally different from the upper limit of 5 atomic percent of the optional rare earth elements set forth in the Japanese Kokai.

A yet further distinction exists with respect to the claimed magnetic properties. Tables 1-3 of the Japanese Kokai show that typical compositions have intrinsic coercivities significantly less than one oersted. Such levels of intrinsic coercivities are far, far less than the one kilo oersted (i.e., 1 Koe) limit in many of the claims of record. Moreover, with such low intrinsic coercivities, it is impossible to obtain an energy product of at least 10 MGOe as set forth in many other claims of record.

Since Japanese Kokai 55-113304 does not disclose, suggest or in any way relate to the presently claimed invention, applicants respectfully submit that this reference cannot be used alone or in combination with any other known prior art to reject any of the claims of record. Hence, applicants respectfully request that the rejections based on the Japanese Kokai be withdrawn.

Japanese Kokai 53-28018 also has nothing to do with the presently claimed invention. The Japanese Kokai describes an anti-corrosive, high-permeability alloy of the sendust type. This alloy is composed of 4-11 weight percent of at least one element selected from the group consisting of titantium, zirconium, rare earth elements, phosphours, boron, niobium, tungsten and manganese, 0.001-2 weight percent of at least one element selected from the group consisting of the platinum group, gold and silver with the balance being iron.

The described sendust type alloy of Japanese Kokai 53-28018 does not in any way resemble the presently claimed invention, much less does it anticipate or render it obvious. As mentioned at the interview and as indicated by the excerpt from the publication "Physics of Magnetism" by S. Chikazumi (provided in Appendix C), sendust-type alloys are generally regarded as "soft" magnetic materials which have coercivities below one oersted. Moreover, it possesses isotropic magnetic properties. Such characteristics are in complete contrast to those aspects of the present invention which require an intrinsic coercivity of at least 1 kilo oersted and anisotropic magnetic properties.

Upon comparing the required composition in the claims of record with that set forth in Japanese Kokai 53-28018, those of ordinary skill in the art can also readily determine that the disclosed composition is nothing like the composition defined in the claims of record. Specifically, the independent claims require the presence of 12-24 atomic percent of the defined rare earth elements whereas the Japanese Kokai discloses 0.01 to 3.5 weight percent of a large group of materials including rare earth elements and boron. Therefore, even if one were to fortuitously select the lightest rare earth element (i.e., cerium) and use the maximum disclosed weight percentage (i.e., 3.5 weight percent), one would still not have a composition with the required amount of rare earth element. Needless to say, such fortuitous selection would mean that the amount of boron (as well as the amounts of all other elements of the group) would be zero which would further distinguish the presently claimed invention over the reference. Manifestly, this reference also cannot properly be used as a basis for rejecting the claims under 35 U.S.C. §102 or §103.

Japanese Kokai 56-47542 and 56-47538 are both owned by Hitachi Metal and relate to an improvement of an inter-metallic compound comprising mainly rare earth elements and cobalt and more particularly to a low rare-earth element, copper-added R_2Co_{17} type permanent magnet alloy (see page 1 of both verified translation). The composition of the alloy may be expressed by the formula:

$$R(Co_{1-x-y-\alpha-\beta})\ Fe_xCu_yM_\alpha M'_\beta)A$$

wherein R is one or a combination of two or more rare earth elements including mainly samarium and/or cerium, M is one or a combination of two or more taken from titanium, niobium, tantalum and vanadium in Japanese Kokai 56-47542 or M is hafnium in Japanese Kokai 56-47538, M' is one or a combination of two or more taken from calcium, sulfur, phosphorus, magnesium and boron in Japanese Kokai 56-47542 and M' is boron in Japanese Kokai 56-47538. The ranges for the amounts of these materials are the same in both Kokai and may be seen in the claims thereof set forth on the first page of the verified translations.

Based on a complete understanding of the fair disclosures of the two Hitachi Kokai, it should be apparent to those of ordinary skill in the art that the claims of record define subject matter which is clearly patentable thereover. As was explained previously, one important aspect, the Hitachi Kokai relate to R_2Co_{17}-type permanent magnet alloys which are known to possess a rhombohedral crystal structure. This fact is demonstrated by the articles entitled "the Structure of Co-Cu-Fe-Ce- Permanent Magnets" and "An Electron Microscope Study of Sm-Co-Cu-Based Magnetic Materials With the Sm_2Co_{17} Structure" which are provided herewith in Appendix D. It will further be noted from the first of these articles that a variation of this formula, namely RCo_5 possesses a hexagonal crystal structure which of course is also different from the the tetragonal crystal structure of the present invention.

A further distinction possessed by the presently claimed invention over the compositions of the two Hitachi Kokai exists with respect to the rare earth elements employed. As plainly stated in the references, samarium and cerium are preferred, which is consistent with the discussion set forth in the two articles provided in Appendix D and the Examples of the two Hitachi Kokai which describe the presence of samarium as the <u>sole</u> rare earth element. In this respect, it is well known in the art that samarium is the key element as "R" in the R_2Co_{17} type magnets.

In contradistinction to the use of samarium and cerium, an extremely expensive rare earth element, the presently claimed invention provides that if samarium and/or cerium are present, at least 50% of the total rare earth element present is composed of the sum of neodymium and/or praseodymium, two elements which are abundantly present and are relatively inexpensive. From a technical standpoint, if samarium or cerium were exclusively poor magnetic properties such as intrinsic coercivity.

Thus, the teaching in the two Hitachi Kokai that samarium and/or cerium should be used as the exclusive or major portion of the rare earth element in the alloy clearly teaches against the presently claimed invention.

A still further distinction possessed by the claims of record over the two Hitachi Kokai concerns the presence of boron. As set forth in Japanese Kokai 56-47542, boron is classified in the same group with the elements calcium, sulfur, phosphorous and magnesium. Since such additional elements may not be substituted for boron in the presently claimed invention, it should be apparent to those of ordinary skill in the art that the element plays a significantly different role in the respective systems. Moreover, if one reviews the level of boron actually used in the examples of Japanese Kokai 56-47538, one finds that it is used in the amounts of .44 atomic percent and .88 atomic percent, levels which are far below the levels required in the claims of record. Therefore, the Hitachi Kokai are deficient in this respect as well.

A yet further distinction concerns the substantial amounts of cobalt and copper described in the references. The claimed term "consisting essentially of" and/or the claimed requirement that at least 50 volume percent of the entire material be occupied by an Fe-B-R ferromagnetic compound precludes any substantial amount of cobalt which will create an Fe-Co-B-R ferromagnetic compound.

As to the presence of copper, it will be appreciated by those of ordinary skill in the art that samarium-cobalt-type permanent magnets require about 9 or 10 atomic percent copper in order for this element to be effective in improving the magnetic properties. This point may be determined by reviewing the contents of the technical literature such as the article entitled "Influence of Cu-Content on the Hard Magnet Properties of Sm(Co,Cu) 2:17 Compounds" which is provided herewith in Appendix E. Additionally, while it has more pertinently been made of record in applicants' Application Serial No. 516,841, applicants' Declaration under 37 C.F.R. §1.132 provided in the concurrently filed Amendment concerning that application demonstrates that for samarium-cobalt-type permanent magnets of the type described in the Hitachi Kokai, as the amount of boron is increased and the amount of copper is correspondingly decreased, the intrinsic coercivity of the magnet substantially decreases.

Conversely, with a composition system as set forth in applicant's Application Serial No. 516,841, the intrinsic coercivity dramatically increases as the amount of boron is increased and the amount of copper is correspondingly decreased. A similar effect will be noted in compositions of the present invention. It is for this reason that the specification teaches on page 17 that the amount of copper should not exceed 3.5 atomic percent.

For all the foregoing significant reasons, applicants respectfully submit that the two Hitachi Kokai cannot in any way be used to reject the claims under 35 U.S.C. §102 or §103. In fact, the fair teachings of such Kokai actually underscore the patentability of the claims.

<u>Koon</u> U.S. 4,402,770, relates to hard magnetic alloy comprising defined amounts of iron, boron, lanthanum and a lanthanide. The non-preferred lanthanides are cerium, praseodymium, neodymium, europium, gadolinium, ytterbium and lutetium. The most preferred lanthanides are terbium, dysprosium, holmium and erbium. The alloys are prepared by heating the corresponding amorphous alloy to a temperature of about 850 to 1200°K in an inert atmosphere until a polycrystalline multi-phase alloy with an average grain size not exceeding 400 angstroms is formed.

As has previously been pointed out and as should be apparent to those of ordinary skill in the art, permanent magnets prepared by rapid quenching of molten material into amorphous or finely crystalline material are <u>not</u> suitable for the preparations of materials or magnets which have anisotropic magnetic properties. It is therefore no wonder that <u>Koon</u> at column 2, lines 3-4 specifically states:

> "And another object is to prepare <u>isotropic</u> permanent magnets having moderately high magnetization" (Emphasis added)

Due to the significant differences between substances which display isotropic magnetic properties and those which are anisotropic in nature, applicants respectfully submit that this distinction should be sufficient for withdrawing <u>Koon</u> as a basis for rejection.

The differences between the isotropic permanent magnets of Koon and the permanent magnets of the present invention are underscored by the recitation in many of the claims that the material or magnet is sintered. If sintering were applied to the alloy of Koon, the essential premise of the microstructure of the rapidly quenched alloys would be destroyed since sintering would generally result in a much coarser crystal grain size (counted as a normal crystalline alloy). The same holds true for all the rapidly quenched alloys.

Notwithstanding the previous points regarding Koon, there are many additional distinctions possessed by the presently claimed invention over the cited reference. In particular, no claim of record encompasses a composition wherein lanthanum is employed as the sole rare earth element. Instead, the claims either require that 50% of the total amount of rare earth element be the sum of neodymium and praseodymium when certain rare earth elements including lanthanum are present or require such amount of neodymium and praseodymium in general. This requirement is in part due to the discovery that the use of lanthanum alone in the composition provides difficulty in yielding a substantially tetragonal crystal structure and does not result in the advantages magnetic properties.

Quite to the contrary to this aspect of applicants' invention, Koon discloses that lanthanum may be used alone and teaches that it must always be present. Moreover, the patent explicitly describes the rare earth elements praseodymium and neodymium as being non-preferred. Thus, if this aspect of the patent teaches anything, it teaches something which is the antithesis of applicants' invention. In this regard, it must be remembered that the relevant portions of a reference include not only teachings that will suggest particular aspects of an invention to one having ordinary skill in the art, but also teachings that will lead away from the claimed invention, In re Mercier, 185 U.S.P.Q. 774 (CCPA 1975). Thus, Koon does not in any way adversely affect the patentability of the claims in record.

To further understand the content of Koon, reference may be made to articles 16 and 17 (authored by Koon et al) of the concurrently filed Information Disclosure Statement. Article 17 discloses on page 841, left column, line 10 et seq., that Fe-B and Fe-Tb intermetallic compounds occur with a grain size less than 1 micron due to crystallization, i.e., annealing. Thus, unlike the present invention, no Fe-B-R ternary intermetallic compounds occur in Koon. Article 16, on page 2334, fig. 3 shows the magnetic ordering temperatures Tc(k), i.e., Curie temperatures of their amorphous alloys. These values are much lower than those of the FeBR alloys of the present invention. The above differences exhibit the occurrence of different crystal phases between the disclosed rapidly quenched ribbon alloys and the Fe-B-R alloys of the present invention.

Japanese Kokai 52-50598 was cited in the Official Action, but was not used in any rejection. Nonetheless, a verified translation of the reference has been provided in order to determine that the presently claimed invention is clearly patentable thereover. As set forth in the verified translation, the Japanese Kokai relates to a rare earth-coblat magnet obtained by compacting a powder of a intermetallic compound comprising 32-42 weight percent of rare earth elements and 58-68 weight percent of the sum of cobalt, iron and nickel to which at least one of tantalum, vanadium, boron, manganese, chromium, zirconium, titanium and niobium is added in an amount of no more than 2.0 weight percent.

As should be apparent to those skilled in the art, the Japanese Kokai is predominantly directed to a samarium-cobalt-type magnet. This can clearly be seen from the Examples wherein large percentages of samarium and cobalt are present with only small amounts of additives. Such disclosure renders it clear that the described magnets do not have the required presence of iron and do not form the Fe-B-R ferromagnetic compound with the substantially tetragonal crystal structure. Moreover, the Japanese Kokai does not recognize the importance of the presence of neodymium and/or praseodymium, particularly when samarium is present and does not distinguish boron from amongst the numerous additives which are set forth. In this regard, it has been repeatedly indicated that boron plays a unique role in the presently claimed invention and results in a magnetic material or magnet which is far different from any which might be obtained if any of the other disclosed elements were substituted for boron.

As a final point of interest in connection with Japanese Kokai 52-50598, applicants have conducted an experiment to determine if the properties described in Table 1 are accurate. To this end, applicants attempted to reproduce the results of Example 3 which

> is arguably the closet to the composition defined in the claims of applicants' application Serial No. 516,841. As may be seen from the Declaration under 37 C.F.R. §1.132 which has been filed in conjunction with that application, precisely following the described procedure resulted in a shape of the silica tube container. Conversely, when the sintering temperature was lowered and the resulting specimen was crushed and measured for magnetic properties, properties far below those set forth in the Table were obtained. Such results included an intrinsic coercivity of 0.4 kOe and an energy product of less than 1 MGOe. Such results underscore the patentability of the claimed invention of applicants' application Serial No. 516,841 and favorably reflect on the patentability of the claims of record in the present application.

207. The Examiner in an Office Action mailed May 8, 1985 (CX-26, Tab 11) again rejected claims 43 to 84 under 35 U.S.C. § 103 as being unpatentable over either Japanese Kokai No. 56-4738 or Japanese Kokai No. 52-50598. Claims 43 to 84 were also rejected under the "judicially created doctrine of obviousness-type double patenting" as being unpatentable over the claims of applicants' copending application, Serial No. 532,572, No. 532,573 and No. 516,814. Claims 43 to 57, 73 to 77, 81 and 83 were further rejected under 35 U.S.C. 103 as being unpatentable over Japanese Kokai No. 54-76419 or Kabacoff et al. Claims 58 to 72, 74 to 82 and 84 were also rejected under 35 U.S.C. § 103 as being unpatentable over Japanese Kokai No. 57-141901. Claims "24 to 43" were further rejected over Chaban et al.

208. Applicants in an amendment dated Nov. 8, 1985 (CX-26, Tab 14) argued about the cited art in the May 8, 1985 Office Action as follows (footnotes omitted):

> Japanese Kokai 56-47538 relates to a R_2Co_{17}-type permanent magnet alloy which has a composition expressed by the formula
>
> $$R(Co_{1-x-y-\alpha-\beta})\ Fe_xCu_yM\alpha M'\beta)A$$

wherein R is one or a combination of two or more rare earth elements including mainly samarium and/or cerium, M is hafnium and M' is boron.

As should be apparent to those of ordinary skill in the art, particularly in view of the discussions set forth above, the fact that the Japanese Kokai specifically states that the magnetic alloy is a "Cu-added R_2Co_{17}-type permanent magnet" should dismiss this reference from consideration. Indeed, the closer one examines the reference the more inevitable this conclusion becomes. In particular, the Kokai makes absolutely no mention of either neodymium or praseodymium and, in light of the fact that it is known that these two elements adversely affect the magnetic properties of this type of samarium cobalt magnet, it certainly would not be obvious to one of ordinary skill in the art to use neodymium and/or praseodymium in an amount of at least 50% of the total amount of rare earth present as required by the claims.

The Japanese Kokai is further deficient by specifically requiring significant amounts of copper in order to obtain the pinning points for this type of permanent magnet (see page 4 of the verified translation). Additionally, although the broad range for boron overlaps that set forth in the claims of record, the examples of the Japanese Kokai use amounts of boron which are far less than that magnetic properties of the described samarium cobalt magnetic are significantly degraded to a coercivity below 1kOe when more than about 2 atomic percent boron is present.

Even if one were to ignore the completely different nature of the described R_2Co_{17}-type permanent magnet and the presently claimed invention and ignore the fact that the Japanese Kokai does not disclose or suggest neodymium and/or praseodymium in an amount constituting at least half of the rare earth element present and ignore that significant amounts of copper are required in the disclosed type of magnets and lead to adverse results in the magnets of the present invention and ignore that small amounts of boron are actually being taught (i.e., less than the lower level claimed) and ignore that the R_2Co_{17}-type system has a hexagonal rather than a tetragonal crystal structure, one would still not arrive at the presently claimed invention since the maximum amount of iron permitted in the disclosed composition is 35.7 atomic percent. This amount is far less than the amount required in the claims of record. Moreover, since the reference specifically indicates that the coercive force of the magnet decreases with increasing iron, one would certainly not attempt to go beyond this disclosed upper limit. Hence, even if one were to pick and choose within the disclosure of the Japanese Kokai based on applicants' own specification (which is clearly not proper), one would still not arrive at the presently claimed invention and it logically follows that this reference cannot be used to reject any of the claims of record.

Japanese Kokai 52-50598 describes a rare earth-cobalt magnet obtained by compacting a powder of an intermetallic compound comprising 32-42 weight percent of rare earth elements and 58-68 weight percent of the sum of cobalt, iron and nickel to which at least one of tantalum, vanadium, boron, manganese, chromium, zirconium, titanium and niobium is added in an amount of no more than 2.0 weight percent.

The rare earth-cobalt magnet described in the Japanese Kokai is totally different from the invention set forth in the claims of record. The disclosed rare earth-cobalt magnet is one the RCo_5-type which is of course a totally different system. As pointed out above, it is known that iron cannot be substituted in this type of magnet to any great amount and this is reflected in that fact that no example has more than 1 weight % of iron in it despite the obvious desirability of using less expensive iron for the relatively expensive and scarce cobalt. Thus, in no way can this reference be construed as meeting the recitation in each of the independent claims of a least 52 atomic percent iron.

The Japanese Kokai is further deficient by indicating that the eight possible additives are optional and for completely failing to recognize the importance of boron in the context of applicants' invention. Indeed, as pointed out above, it is well known in the art that boron is not necessarily required to obtain good magnetic properties in samarium cobalt-type magnets and will actually adversely affect the magnetic properties thereof.

Even if one looks at the closet composition which is the fourth sample set forth in Table 1 of the Japanese Kokai, such a composition is deficient with respect to both the amount of boron (which is totally absent) and the amount of iron which is only one weight percent (which is consistent with the recognition that RFe compounds do not exists). Moreover, as was demonstrated in the Declaration which was previously presented in application Serial No. 516,841 and now included in Appendix F herewith, applicants have attempted to repeat this composition and have found that the described sintering temperature resulted in a complete melting of the initial ingot. When the sintering temperature was lowered and the resulting specimen was crusted and measured for magnetic properties, properties far below those set forth in the Table were obtained. Thus, this evidence as well as the complete failure of the Japanese Kokai to disclose or in anyway suggest the presently claimed invention leads to the proper conclusion that this reference cannot in any way support a rejection under 35 U.S.C. §103.

Japanese Kokai 54-76419 relates to highly magnetostrictive materials of the formula $R_xFe_YM_z$ wherein R is a rare earth element, M is a metalloid element such as silicon, boron, phosphorus and carbon, x is 4-35, y is 25-77 and z is 5-38. The materials, which may be used in ultrasonic osciallators, etc., are prepared by rapid quenching from the melt and are disclosed as being amorphous.

There are numerous reasons whey the Japanese Kokai is totally different from the invention defined in the claims of record. Specifically, the material is prepared by a rapid quenching technique which is known in the art to yield <u>isotropic</u> magnetic properties. Such properties specifically defined in the claims of record and, as recognized by the General Motors Researcher, R.E. Lee, in the article described above, there was no simple way of converting rapidly quenched ribbon into an anisotropic material.

Although the foregoing distinction should in and of itself be sufficient to dismiss the Japanese Kokai from providing a proper ground for rejection, there exist numerous other significant reasons which patentably distinguish the claims of record over the reference. In particular, the Japanese Kokai specifically requires a highly magnetostrictive material. Magnetostriction is a totally different property from hard or permanent magnetism which is based on coercivity. A typical use of magnetostrictive material is an oscillator or transducer which is responsive to the frequent changes of the magnetic field. Practically, such magneto-mechanical transducers are the principal application of the magnetostictive materials. The tunable SAW (surface-acoustic-wave) device is one of such transducers and is described in an article of E.M.. Simpson et al, Univ. of Minn. entitled "Magnetostrictive Fe-Si Thin Films for Tunable Saw Devices" wherein it is stated in the Introduction:

> "Suitable materials for this application may be some of the amorphous metallic glasses which combine large magnetostriction (λ s - 30 x 10^{-6}) and low coercitities (Hc≤ 10 Oe)." (Emphasis added, copy provided in Appendix G)

Low coercivity of the material is necessary for a transducer used as an oscillator since the large coercivity resists the changes of the magnetic field which will make it ineffective or at least cause hysteresis loss. Thus, as far as an oscillator, such as disclosed in the Japanese Kokai, or a like transducer is concerned, the magnetostrictive material must have a low coercivity. Such a low intrinsic coercivity (which is far less than the 1 kOe required in many of the claims) cannot lead to a maximum energy product of at least 10 MGOe which is required by every independent claim of record.

As yet further distinctions, the Japanese Kokai does not in any way recognize that boron is different from the other named elements and is essential to the present invention and that neodymium and/or praseodymium, must be present in an amount of at least 50% of the entire amount of rare earth element present. Indeed, neodymium and praseodymium are not mentioned in the disclosure and are not present in any amount in any of the examples. Thus, when one considers all the deficiencies of the Japanese Kokai, it is beyond doubt that the claims are patentable over this reference.

Japanese Kokai 57-141901 also cannot be used in any way to reject the presently claimed invention. It will be initially noted that the Japanese Kokai has a publication date of September 2, 1982. This date is subsequent to the first priority date of the present application of August 21, 1982 and therefore the Japanese Kokai cannot be used to reject any of the claims supported by the priority document.

Even assuming that the Japanese Kokai could be considered "prior art", it still would neither disclose nor suggest the presently [sic] invention. The Japanese Kokai relates to permanent magnet powders obtained by heat treating an amorphous alloy in the presence or absence of a magnetic field, the alloy being expressed by the general formula:

$$(T_{1-x} M_x)_z R_{1-z}$$

wherein x is greater than or equal to 0 and less than or equal to 0.35 and z is greater than or equal to 0.35 and less than or equal to 0.90, T is one or more transition metals, M is one or more metalloids selected from boron, silicon, phosphorus and carbon and R is one or more rare earth elements.

The amorphous alloy disclosed in the Japanese Kokai is completely foreign to the magnetic materials defined in the claims of record. As has been repeatedly been pointed out, boron is essential to the presently claimed invention and this element yields results which are not obtained by silicon, phosphorus and carbon. The Japanese Kokai explicitly indicates that <u>zero</u> percent metalloid may be present and does not in any way appreciate the importance of boron over the other elements. Indeed, from page 4 of the verified translation, it may be seen that <u>silicon</u> is the preferred metlloid element.

The Japanese Kokai is also deficient by failing to appreciate the importance of neodymium and praseodymium. To the extent that neodymium or praseodymium are used in the Examples, <u>none</u> of such Examples have the required amounts of iron and either of these two required elements. Moreover, to the extent that the maximum energy products are set forth for any of the exemplified alloys (see Examples 4 and 5) the reported values are far less than the minimum values set forth in the claims of record. Therefore, even if the Japanese Kokai could be considered to be "prior art", it still would not disclose or in any way suggest the presently claimed invention and could not be properly used to support a rejection of any of the claims of record.

The article by Kabacoff et al describes amorphous ribbons of the formula $Pr_x(Fe_{0.8}B_{0.2})_{1-x}$ wherein x range from 0 to 0.30. The amorphous ribbons are melt spun onto a copper wheel under an argon atmosphere and the magnetic properties are reported.

These properties include a room temperature coercive force which was too small to measure (i.e., less than 5 Oe which is 0.005 kOe).

As has been fully explained in this specification and as has been repeatedly stressed throughout the prosecution of the present application, the present invention is much more than a simple compositional alloy. Instead, it is a material which is magnetically anisotropic and which has carefully defined magnetic properties and a crystal structure which is distinctive from known samarium cobalt type magnets and amorphous materials.

The article by Kabacoff et al completely fails to appreciate what applicants have invented and have claimed. The fact that the article includes <u>zero</u> percent praseodymium is clear evidence that the element is optional which is in complete contrast to the importance which this element (or neodymium) plays in the presently claimed invention. Additionally, the ribbons are explicitly stated as being <u>amorphous</u> which by their very nature means that they are <u>not</u> anisotropic. Moreover, as was pointed out above, no simple way existed of transforming the amorphous ribbons into an anisotropic material even if the appropriate composition were obtained.

As a still further distinction over the disclosed amorphous ribbons, the claims of record specifically require a maximum energy product of at least 10 MGOe and many of the claims additionally specify an intrinsic coercivity of at least 1 kOe. Such magnetic properties are <u>not</u> obtained by the amorphous ribbons disclosed in the article as plainly indicated by the fact that the article itself reports that the intrinsic coercivity of the ribbons was "two small to measure". Hence, when one considers each and every recitation in the claim, as one must, there should be no question that the claims are clearly patentable over this piece of prior art.

The article by Chaban et al has nothing to do with permanent magnets of any type, shape or form. As such, the article has no more relevance than any other publication discussing an iron alloy. All the article describes is the phase equilibria of R-Re-B ternary systems wherein R is neodymium, samarium or gadolinium.

It must again be pointed out that the present invention is <u>not</u> simply an alloy composition. Instead, it is a permanent magnet or magnetic material which has carefully defined features, all of which are important and only one of which relates to the composition.

Even if one were to fortuitously select only the neodymium system over the samarium and gadolinium systems (without any apparent reason to do so), there are still further reasons why the article by Chaban et al does not disclose or suggest the presently claimed invention. More specifically, even within the neodymium-iron-boron system, there are <u>non</u>-magnetic phases such as $Nd_2Fe_7B_6$ and Nd_2FEB_3, which are all non-magnetic at room temperature. Moreover, the article does not recognize the $R_2Fe_{14}B$ magnetic phase which occurs in the present invention and even explicitly states with respect to the closet compound:

> "We were unable to obtain any data on the crystal structure of the compounds -$R_3Fe_{16}B$ and -R_2FeB_3, since we were not successful in growing the corresponding single crystals."

The explicit statement in the article that the authors were unsuccessful to obtain any data on the crystal structure of what is arguably the closet compound and the complete lack of any recognition of magnetic properties is clear evidence that the article has failed to be sufficiently enabling to be considered "prior art" against the presently claimed invention.

209. Applicants, in the amendment dated Nov. 8, 1985 (CX-26, Tab 14) referring to the "double patenting rejection" argued:

> As a final matter, it is believed that the obviousness-type double patenting rejection with respect to the claims of application Serial Nos. 532,472,532,473 and 516,841 [application on which '368 patent is based] is not applicable in view of the foregoing discussion and the amendments to the claims. This is particularly true with respect to the first two of these applications which are directed to carefully defined improvements which are not suggested in the claims of the present application. However, to avoid any allegation of prolongation of the period for patent protection, applicants have concurrently filed Amendments in

three of the four applications (and the fourth will be filed in a few days) so that the applications may be reviewed and allowed concurrently.

210. The Examiner in a Office Action dated 5/14/86 (CX-26, Tab 18) rejected claims 44, 46, 49 to 57, 59, 61, 64 to 72, 75, 78, 69, 85 and 86 under 35 U.S.C. 103 as being unpatentable over Japanese Kokai No. 56-47, 538 on the grounds inter alia that the composition of the reference overlaps applicants' claimed composition and certain claims are silent with respect to the tetragonal structure.

211. Applicants responding to the Office Action dated May 14, 1986 (CX-26, Tab 19) applicants argued (footnote omitted):

> As to the prior art rejection under 35 U.S.C. §103 over Japanese Kokai 56-47, 538, applicants believe that the prior art is not applicable for reasons substantially set forth in the previously filed Amendments. Moreover, in light of the recitation of the rare-earth ranges now present in the independent claims, it is believed that this prior art rejection should be withdrawn. This is particularly true in light of the Examiner's statement on page 7 of the Official Action that:
>
> > "It is noted that if the claims are amended to recite along the lines discussed in the new matter rejection, i.e. to have an Fe content of at least 5b [sic 56] at.% and an upper limit of 20 at.% R, this rejection will be withdrawn."
>
> Regarding the provisional double patenting rejection, applicants respectfully point out that none of the cited applications has matured into a patent and that the mere fact that there may be some overlapping of the proportions of certain constituents is essentially irrelevant in assessing the presence of "obviousness-type double patenting".

212. The Examiner in an Office Action dated 11/10/86 (CX-26, Tab 21) rejected claims 43, 46 to 50, 52, 54 to 59, 61 to 65, 67, 69 to 72, 74, 75, 76 to 79 and 81 to 86 as

directed to the same invention as that of claims 34 and 35 of commonly assigned U.S. Pat. No. 4,601,875 and also "provisionally" rejected those claims under the "judicially created doctrine of obviousness-type double patenting" as being unpatentable over the claims of copending application Serial Nos. 532,472 and 567,640.

213. The Examiner in an Office Action dated 10/9/87 (CX-26, Tab 36) rejected claims 43, 46 to 50, 52, 54 to 59, 61 to 65, 67, 69 to 72, 74, 75, 77 to 79 and 81 to 88 under the "judicially created doctrine of obviousness-type double patenting" as being unpatentable over claims of copending application serial no. 567,640 or copending application serial no. 532,473 or the claims of U.S. Patent No. 4,684,406 or 4,601,875.

214. On October 26, 1987 there was submitted a terminal disclaimer which disclaimed the terminal part of any patent granted on Serial No. 013,165 which would extend beyond July 22, 2003. (CX-26, Tab 38).

215. The Examiner on February 29, 1981 (CX-26, Tab 41) in a notice of allowability stated that claims 43, 46 to 50, 52, 54 to 58, 61 to 65, 67, 69 to 72, 74, 75, 77 to 79 and 81 to 88 were allowed.

XIV. Prosecution Of The Claims In Issue Of The '651 Patent

216. Continuation Serial No. 485,183 filed June 7, 1995 and on which the '651 patent is based contained 59 original claims as filed. (CX-30, M 008119 to 8130). However on filing Ser. No. 485,183 original claims 1 to 31 were cancelled. (CX-31, Tab 3). Independent claims 1 and 2 were directed to "[a] crystalline permanent magnet alloy..." while independent claims 32 and 37 were directed to "[a] crystalline permanent magnet..." The remaining original claims were dependent claims.

217. Applicants, in a preliminary amendment filed Nov. 2, 1995 (CX-31, Tab 5), cancelled original claims 32 to 59 and added new claims 60-83 on the grounds that the "claims have been amended to present the subject matter applicants elect to prosecute at this time." (CX-31, Tab 5). Claims 1-3 in issue corresponds to claim 60 to 62. Claims 15, 18, 19, 21 and 22 in issue corresponds to amended claims 74, 77, 78, 80 and 82 respectively. (CX-31, Tab 5). Claim 5 in issue corresponds to amended claim 64. (CX-31, Tab 8). New claim 60 added by the amendment filed November 2 read:

> 60. A crystalline R(Fe,Co)BXAM compound having a tetragonal crystal structure having lattice constants of a_o about 8.8 angstroms and c_o about 12 angstroms, in which R is at least one element selected from the group consisting of Nd, Pr, La, Ce, Tb, Dy, Ho, Er, Eu, Sm, Gd, Pm, Tm, Yb, Lu and Y, X is at least one element selected from the group consisting of S, C, P and Cu, A is at least one element selected from the group consisting of H, Li, Na, K, Be, Sr, Ba, Ag, Zn, N, F, Se, Te and Pb, and M is at least one element selected from the group consisting of Ti, Ni, Bi, V, Nb, Ta, Cr, Mo, W, Mn, Al, Sb, Ge, Sn, Zr, Hf and Si.

218. The Examiner in an Office Action dated 6/11/96 (CX-31, Tab 7), as to claims 60 to 83, stated:

> *Claim Rejections - 35 U.S.C. § 112*
>
> 1. Claims 60 to 83 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
>
> Claims 60 to 83 are indefinite because it has been held that claims drawn to an alloy without defining alloying ranges are merely functional, and are therefore indefinite since it defines a composition in terms of results to be produced rather than actual quantities to be added. See Koebel v. Coe, 505 OG 513.
>
> The phrase "negligible amounts" is indefinite because there is no definition or antecedent basis in the specification.
>
> *Allowable Subject Matter*

> 2. Claims 60 to 83 would be allowable if rewritten or amended to overcome the rejection under 35 U.S.C. 112.
>
> 3. The following is an Examiner's statement of reasons for the indication of allowable subject matter: The crystalline R(Fe,Co)BXAM compound having a tetragonal crystal structure having lattice constants of a about 8.8 angstroms and c about 12 angstroms, as claimed, is not shown or fairly suggested by the art of record.

Claim 63 had read "The crystalline compound of claim 60 wherein in the group (Fe, Co) Fe is present in a negligible amount."

219. Applicants in the amendment filed October 3, 1986 (CX-31, Tab 8) amended claim 60 to add the word -- stable -- before "tetragonal." The amended claim thus became identical to independent claim 1 in issue. In the remarks section it was argued:

> In the telephone conference the undersigned pointed out that the claims are drawn to compounds, not alloys, and that intent of the phrase "present in a negligible amount" was intended to refer to compounds in which the stated substituent was not present to any meaningful degree.
>
> Applicants respectfully point out to the Examiner that all of the claims are directed to crystalline compounds of a stable tetragonal structure and are not alloy claims. The language "present in a negligible amount" has been amended as necessary to state that the substituent is –not present– in the compound. The specification contains many examples and references to such compounds.

The amendment cancelled "in a negligible amount" from amended claims 63, 64, 67, 68, 69, 70, 71, 72 and 73. (CX-30, M 008166-67).

220. The Examiner in a notice of allowability dated Nov. 11, 1996 (CX-31, Tab 10)

stated that claims 60 to 83 were allowed. On the same date a notice of allowance was issued. (CX-30, M 008171).

XV. Terms

221. "Anisotropic," or "magnetic anisotropy," means that the properties of the magnet, e.g., its coercivity, remanence, and maximum energy product, are different when measured in different directions of the magnet. (Guruswamy, Tr. at 474, 620).

222. "Atomic percent" refers to the amount of a particular element in a composition. Specifically, the atomic percent measures the number of atoms of that element in the composition relative to the total number of atoms that are present in that composition. (Guruswamy, Tr. at 294, 325).

223. The "combined atomic fraction" of two elements, as used in the '058 patent, is found by taking the total amount of those two elements (e.g., iron and boron), and then calculating the fraction of that combined amount compared to the total amount of the atoms in the composition. (Guruswamy, Tr. at 770-71).

224. A "crystal," or "crystalline" material, means that the atoms in the compound are arranged in an orderly, three-dimensional structure, or array, which provides the basic building blocks or unit cells for the material. (Guruswamy, Tr. at 364, 573).

225. "Curie temperature," also known as the "magnetic ordering temperature," refers to the temperature above which the magnetically hard alloy will completely lose its magnetic properties (e.g., its magnetization, energy product) and become non-magnetic. (Guruswamy, Tr. at 331, 439, 748). In other words, the material in question cannot work as a permanent magnet above that temperature. (Guruswamy, Tr. at 332).

226. "Energy product at magnetic saturation" (also called the "maximum energy product") measures the potential energy that can be stored in the magnet; in other words, the energy product measures the amount of work a magnet can do. The energy product is also a measure of how much energy would be required to demagnetize the magnet. (Guruswamy, Tr. at 284, 319-21, 404).

227. A "grain" is a single crystal in a material. (Guruswamy, Tr. at 669, 769).

228. "Intrinsic magnetic coercivity," also known as "intrinsic coercivity" or "inherent intrinsic magnetic coercivity," represents the strength of the demagnetization field needed to bring the magnetization of the magnet or magnetic material to zero. (Guruswamy, Tr. at 337, 338, 341). Intrinsic coercivity, a common property of magnets and magnetic materials, is measured in Oersteds ("Oe") or kiloOersteds (equal to 1,000 Oersteds). (Guruswamy, Tr. at 342).

229. "Lattice parameters," or "lattice constants," refers to the dimensions of the unit cell, or building block, of a crystalline material. In particular, the quantity "a_0" (also "a" or "A_0") set forth in certain asserted claims represents the length of the base of a tetragonal crystal (the "crystallographic a-axis" in certain claims). The quantity "c_0" (also "c" or "C_0") is the height (the "crystallographic c-axis" in certain claims) of a tetragonal crystal. (Guruswamy, Tr. at 255-56, 398-99; CPX-28).

230. The term "magnetic phase" refers to a region in a magnet that has uniform ferromagnetic properties. (Guruswamy, Tr. at 440, 443, 670-71).

231. The "mean crystal grain size," or "mean crystalline grain size," refers to the average size of the grains in the magnet. (Guruswamy, Tr. at 487, 544).

232. A "nonmagnetic phase" is a phase that does not have permanent magnetic properties. (Bohlmann, Tr. at 1326; Guruswamy, Tr. at 545-46).

233. A "phase" refers to a region in a material that has uniform properties, such as uniform composition, physical properties, magnetic properties, electrical, and/or other properties. A material can have more than one phase. (Guruswamy, Tr. at 255, 363-64, 669-70).

234. The "predominant phase" of the material would be that phase that is present in the largest amount in the magnet, typically in an amount exceeding 50 percent of the total. (Guruswamy, Tr. at 359-60).

235. "Remanence," which is measured in Gauss, measures the strength of the internal magnetic field of the magnet or magnetic material after an external magnetizing field has been removed. (Guruswamy, Tr. at 283, 319, 337, 341-42).

236. "Sintering" may be performed in many different types of atmospheres or even in a vacuum; in other words, it need not be performed in argon or any other particular atmosphere. (Guruswamy, Tr. at 473-74, 523-24, 723; Bohlmann, Tr. at 1747). In addition, the temperature at which a product is sintered depends on the product in question. (Guruswamy, Tr. at 660-65).

237. A "stable tetragonal crystal structure" means that the tetragonal structure is an equilibrium phase, or equilibrium crystal structure. (Guruswamy, Tr. at 575-76).

238. Certain claims in issue refer to the "$RE_2TM_{14}B_1$ phase," which is a phase having a ratio of 2 atoms of a rare-earth (RE) element for every 14 atoms of a transition metal (TM), and 1 atom of boron (B) (see, e.g., CX-2, col. 26, lines 12, 23, 64; Guruswamy, Tr. at 364-

65). The neodymium 2, iron 14, boron 1 alloy is commonly referred to as the "2-14-1" phase. (Guruswamy, Tr. at 259-60).

239. The $RE_2TM_{14}B_1$ phase can also be expressed as a $RE_2(Fe_{1-x}TM_x)_{14}B_1$ or $RE_2Fe_{14-x}TM_xB_1$ phase, as in claims 19 and 20 of the '931 patent, when it contains transition metals other than iron, and where "x" is the amount of transition metal in the magnet or magnet alloy relative to the amount of iron therein (see CX-2, col. 28, lines 27, 40). The $RE_2TM_{14}B_1$, phase can also be expressed as a $RE_2\ Fe_{1-x}Co_{x14}B_1$, phase, as in claim 18 of the '931 patent, when it contains cobalt (Co), where "x" is the amount of cobalt in the magnet or magnet alloy relative to the amount of iron therein. (See CX-2, col. 28, lines 15-18).

240. Claim 8 of the '058 patent describes the claimed neodymium-iron-boron composition in terms of the formula "$RE_{1-x}(F_{1-y}B_y)_x$". A person of ordinary skill in the art would understand that formula to mean that the alloy includes the elements neodymium and/or praseodymium (identified as RE), iron (F, which is a misprint for the correct label "Fe"), and boron (B) (Guruswamy, Tr. at 335-36, 360-63). The values of "x" and "y" in the subscripts describe the relative amounts of the elements in the alloy; namely, "x" refers to the combined amount of iron plus boron in the alloy relative to the total amount of the alloy, and "y" refers to the amount of boron relative to the amount of iron in the alloy. (Guruswamy, Tr. at 336). For example, a formula in which "x" is 0.6 indicates that the combined amount of iron and boron (x) should be 60 atomic percent of the total alloy, and the amount of neodymium and/or praseodymium (RE) should be 40 atomic percent. (Guruswamy, Tr. at 348, discussing CX-1, col. 2, lines 66).

XVI. Tests

241. Complainants obtained samples of magnets from certain respondents and former respondents and assigned them identification numbers, as follows:

Party	Sample number	Party's number
American Union Group	ZSCC-225-015	----
A.R.E.	ZSCC-225-014	----
CYNNY	ZSCC-225-016	----
H.T.I.E.	ZSCC-225-003	----
Houghes	ZSCC-225-020A ZSCC-225-020B	901 902
Multi-Trend	ZSCC-225-004	----
Harvard	ZSCC-225-019A ZSCC-225-019B ZSCC-225-019C	701 702 703
High End	ZSCC-225-021D ZSCC-225-021E ZSCC-225-021F ZSCC-225-021G ZSCC-225-021H ZSCC-225-021I	104 105 106 107 108 109
NEOCO	ZSCC-225-022A	----

(Guruswamy, Tr. at 252-53; CX-50; Witness Statement of Dr. Viswanathan Panchanathan ("CX-72, Qs. 21, 22). The sample numbers in the middle column were given and used by Magnequench to identify the magnets. (Guruswamy, Tr. at 641-42; CX-72, Q22).

242. Complainants' expert Guruswamy, in presenting his analysis of the test results of a party's magnet, sometimes used the identification numbers provided by the party (third column, supra) in reporting the results of some of his tests and analyses. (Guruswamy, Tr. at 642-44,

discussing CX-48, Tabs 48-54, 67-73; CX-50).

243. Although Respondents Xin Huan, Jing Ma, and{ }did not submit sample magnets in discovery, they are related to the other respondents in the following manner. Respondent{ }purchased its Nd-Fe-B magnets from respondent Xin Huan and imported them from China into the United States. (Order No. 38 at 5-6). Respondent{ }in turn, obtained its Nd-Fe-B magnets from{ } (Id. at 6-7). Respondent{ }purchased and imported its Nd-Fe-B magnets from Jing Ma. (Id. at 11).

244. Complainants also obtained headphones made by third-party AIWA and a microphone made by third-party GEC. The magnets were removed from the products so as to be able to test the magnets for their chemical compositions and magnetic properties. (CX-72, Q. 39).

245. The magnets from these third party products were assigned the following identification numbers:

Third Party	Sample Number
Aiwa	ZSCC-225-025
GEC	ZSCC-225-026

(Guruswamy, Tr. at 634-35; CX-49, Tabs 18, 19; CX-72, Q. 39; CX-73, Q. 36).

246. Complainants, through their experts Dr. Panchanathan and Dr. Guruswamy, had chemical composition tests, magnetic properties tests, X-ray diffraction tests, and scanning electron microscopy (SEM) tests performed on obtained magnets. (CX-72, Qs. 14-43; CX-73-C, Qs. 9-12, 35-38; CX-76, Qs. 34, 38, 50).

247. At Panchanathan's request and direction, the chemical composition tests were

performed by or under the direct supervision of Mr. Steven Barr at Magnequench. (CX-73, Qs. 9-12). At Panchanathan's request and direction, the magnetic property tests were performed by Mr. Ferris Daugherty at Magnequench. (CX-74, Qs. 4-8).

248. Complainants' expert Dr. Panchanathan requested three types of chemical composition tests be performed on obtained magnets of respondents and former respondents a chemical analysis, a determination of the oxygen/nitrogen content of each magnet, and a determination of the carbon/sulfur content of each magnet. Also he requested that chemical analysis tests be performed on the magnets from third party products. (CX-72, Qs. 14, 21-26, 43; CX-73, Qs. 9-13, 16-18, 22, 25-27, 29, 31-33, 35-38; Guruswamy, Tr. at 634, 705).

249. The chemical analysis tests were performed by Mr. Barr and or under his supervision using an inductively coupled plasma (ICP) spectrometer. (CX-72, Q. 15; CX-73, Q. 13). The ICP tests determined the presence and concentrations of the different elements in the magnets of respondents and former respondents and the third-party magnets. (Guruswamy, Tr. at 271-272; CX-73, Q. 13, 25-26). Specifically, the samples were tested for the presence of: (i) rare-earth elements, such as neodymium, praseodymium, and others; (ii) transition metals, such as iron and cobalt; and (iii) metalloids, such as boron. (CX-72, Q. 15; Guruswamy, Tr. at 271-73). In addition, a high temperature combustion process was performed on the of magnets of respondents and former respondents to determine their carbon and sulfur content and an inert gas fusion process was performed to determine the oxygen and nitrogen content of said magnets. (CX-72, Qs. 22, 29).

250. The test results given in CX-48, tabs 1-19, provide both the corrected values and normalized values for the quantities of each element present in the magnets. (Guruswamy, Tr. at

272, 280-81; CX-73, Q. 15). Due to experimental variables, the total of the "corrected values" may differ from one hundred percent (100%) by a few percent. (Guruswamy, Tr. at 274-76). Consequently, the tester assumed that all those elements listed should total one hundred percent, and thus a statistical correction was performed so that the elements total to one hundred percent. Those values for each element are listed as the "normalized" values. (Guruswamy, Tr. at 275-77). Specifically, the corrected value for each element is divided by the sum of all the corrected values and then multiplied by 100 to yield the normalized value. (Guruswamy, Tr. at 277). The use of corrected and normalized values is a standard practice in this field when conducting these types of tests. (Guruswamy, Tr. at 274-277).

251. Some of the values provided in CX- 48, tabs 1-19, are accompanied by an "out of limit flag." (Guruswamy, Tr. at 272). An "out of limit flag" indicates that the quantity, or weight percent, of the element in question in a particular magnet sample falls outside the manufacturing specification, or standard range of values, for a Magnequench commercial product. (Guruswamy, Tr. at 272; CX-73, Q. 19).

252. The "out of limit flag" was created and used by Magnequench for internal quality control purposes; it is not relevant for tests performed on any non-Magnequench product. (CX-73, Q. 19). In other words, the "out of limit flags" have nothing to do with the patents at issue (Guruswamy, Tr. at 272). The "out of limit flags" are listed in the test results of respondents' magnets simply because the same computer software used in testing in Magnequench products was used to test those magnets. (CX-73, Q. 19).

253. The results of Barr's chemical composition tests were accompanied by margins of error, which is a measure of the outer limits of the uncertainty regarding a particular

measurement. (Barr, CX-440, Qs. 3, 4, 6, 9, 16). Magnequench routinely uses margins of error when it conducts chemical composition tests on samples. (CX-440, Q. 5). Margins of error can be calculated for the NEOCO and other magnets that were tested. (CX-440, Qs. 8, 11, 14, 18, 20, 24, 26).

254. The results of the chemical composition tests requested by Panchanathan were sent to Guruswamy for his evaluation and analysis. (Guruswamy, Tr. at 705).

255. Complainants' expert Panchanathan also requested certain tests to determine the magnetic properties – specifically, the intrinsic coercivity, remanence, and maximum energy product – of the magnets obtained from the respondents and from the third party products. (CX-72, Qs. 14, 19, 27-42; CX-74, Qs. 4-7, 11-19; Guruswamy, Tr. at 282).

256. The magnetic properties tests produced a demagnetization curve for each magnet, from which the intrinsic coercivity, remanence, and energy product value of the magnet can be determined. (CX-72, Qs. 28, 30-31, 33-34, 36-37; Guruswamy, Tr. at 282, 318-19). The intrinsic coercivity of each magnet was measured at room temperature. (CX-72, Qs. 30, 31).

257. The results of the magnetic properties tests requested by Dr. Panchanathan were sent to Dr. Guruswamy for his evaluation and analysis. (Guruswamy, Tr. at 705).

258. Complainants' expert Guruswamy performed, or had others perform under his supervision and direction, X-ray diffraction tests on respondents' magnets. (CX-76, Qs. 34-37; Guruswamy, Tr. at 252-53, 705).

259. The purpose of the X-ray diffraction tests was to determine the crystalline structures of each magnet, the type and amount of crystalline phases contained in the magnet, and the lattice parameters that are characteristic of the unit cell, or building block, of the crystalline

material. (CX-76, Qs. 38, 47-48; Guruswamy, Tr. at 253-54).

260. Each of the different phases in the magnet yields a characteristic pattern of "peaks," from which one can identify the crystalline structure of the magnet. (Guruswamy, Tr. at 253-54).

261. For example, the $Nd_2Fe_{14}B_1$ phase (also known as the "2-14-1 phase") is characterized by a particular crystalline structure; specifically, it has a tetragonal crystal structure wherein the lattice parameters, or lattice constants, have particular values. (Guruswamy, Tr. at 364). The 2-14-1 phase thus yields a standard X-ray diffraction pattern, which is given in tab 56 of CX-48. (CX-76, Q. 45; CX-48, Tab. 56; Guruswamy, Tr. at 259-60).

262. Complainants' expert Dr. Guruswamy also performed, or had others perform under his supervision and direction, scanning electron microscopy ("SEM") tests on respondents' magnets. (CX-76, Q. 34; Guruswamy, Tr. at 252-53, 260, 705).

263. An SEM test is used to determine the size and shape of the grains in the sample, from which one can determine whether the magnet is a sintered magnet. (CX-76, Qs. 51, 52, 57; Guruswamy, Tr. at 260, 264-67).

264. The results of complainants' chemical composition and magnetic properties tests on the magnets obtained from respondents, former respondents and products manufactured by third-parties AIWA and GEC are presented in the following tables. The results are presented in full in complainants' CX-48, CX-49, CX-51, CX-52, and CX-53.

SUMMARY OF TEST RESULTS	AUG ZSCC-225-015	CYNNY ZSCC-225-016	H.T.I.E. ZSCC-225-003
Rare Earth Elements (atomic percent)			
Gd - Gadolinium	0.0189	0.0153	0.0000
Dy - Dysprosium	0.5857	0.5403	0.5470
Pr - Praseodymium	4.3436	0.0925	0.0618
Nd - Neodymium	8.9273	13.8719	13.9422
La - Lanthanum	0.0336	0.0280	0.0341
Ce - Cerium	0.0288	0.0146	0.0418
Sm - Samarium	0.0000	0.0070	0.0468
TOTAL RARE EARTH	13.9378	14.5696	14.6737
Transition Metals (atomic percent)			
Fe - Iron	76.6058	73.1139	74.5749
Co - Cobalt	0.1070	0.1090	0.0000
Mn - Manganese	0.1366	0.1665	0.1609
Zr - Zirconium	0.0028	0.0000	0.0000
TOTAL TRANSITION METALS	76.8522	73.3894	74.7358
Metalloids (atomic percent)			
B - Boron	5.9571	7.0705	7.3534
Mg - Magnesium	0.0000	0.0000	0.0000
Ga - Gallium	0.0100	0.0097	0.0089
Al - Aluminum	0.9327	1.9007	0.8767
Ca - Calcium	0.0016	0.0031	0.0031
Na - Sodium	0.0082	0.0296	0.0190
TOTAL METALLOIDS	6.9095	9.0135	8.2610
Others (atomic percent)			
O - Oxygen	1.7199	2.3317	1.5165
N - Nitrogen	0.4091	0.0781	0.0396
C - Carbon	0.1696	0.6158	0.7447
S - Sulfur	0.0020	0.0019	0.0287
TOTAL OTHERS	2.3005	3.0275	2.3295
INTRINSIC COERCIVITY (kiloOersteds)	15.2	12.4	9.2
ENERGY PRODUCT (megaGaussOersteds)	36.0	31.5	26.0
REMANENCE (kiloGauss)	12.7	11.8	11.6

SUMMARY OF TEST RESULTS	Houghes (sample A) ZSCC-225-020A	Houghes (sample B) ZSCC-225-020B	Multi-Trend ZSCC-225-004
Rare Earth Elements (atomic percent)			
Gd - Gadolinium	0.0118	0.0125	0.0000
Dy - Dysprosium	0.5743	0.7066	0.4793
Pr - Praseodymium	0.1213	0.1365	4.3319
Nd - Neodymium	14.1078	13.8238	10.1259
La - Lanthanum	0.0373	0.0364	0.0231
Ce - Cerium	0.0137	0.0117	0.0405
Sm - Samarium	0.0162	0.0143	0.0298
TOTAL RARE EARTHS	14.8823	14.7419	15.0305
Transition Metals (atomic percent)			
Fe - Iron	74.7033	71.7135	74.0764
Co - Cobalt	0.1195	2.2328	0.0000
Mn - Manganese	0.1782	0.1739	0.2030
Zr - Zirconium	0.0000	0.0000	0.0000
TOTAL TRANSITION METALS	75.0011	74.1202	74.2794
Metalloids (atomic percent)			
B - Boron	7.4246	7.1865	6.1147
Mg - Magnesium	0.0000	0.0000	0.0000
Ga - Gallium	0.0266	0.0245	0.0000
Al - Aluminum	0.4436	1.2215	1.0205
Ca - Calcium	0.0032	0.0032	0.0016
Na - Sodium	0.0334	0.0330	0.0164
TOTAL METALLOIDS	7.9314	8.4687	7.1533
Others (atomic percent)			
O - Oxygen	0.9532	1.7634	2.9194
N - Nitrogen	0.7571	0.5422	0.2084
C - Carbon	0.4748	0.3634	0.3992
S - Sulfur	0.0002	0.0002	0.0098
TOTAL OTHERS	2.1853	2.6693	3.5369
INTRINSIC COERCIVITY (kOe)	10.7	13.9	12.4
ENERGY PRODUCT (MGOe)	29.2	30.0	34.0
REMANENCE (kiloGauss)	11.4	11.3	12.0

SUMMARY OF TEST RESULTS	Harvard (sample A) ZSCC-225-019A	Harvard (sample B) ZSCC-225-019B	Harvard (sample C) ZSCC-225-019C
Rare Earths (atomic percent)			
Gd - Gadolinium	0.0133	0.0126	0.0155
Dy - Dysprosium	0.7574	0.7418	0.9341
Pr - Praseodymium	0.1301	0.1203	0.1293
Nd - Neodymium	13.5852	14.1247	13.6953
La - Lanthanum	0.0333	0.0359	0.0342
Ce - Cerium	0.0107	0.0110	0.0101
Sm - Samarium	0.0134	0.0153	0.0145
TOTAL RARE EARTHS	14.5434	15.0616	14.8330
Transition Metals (atomic percent)			
Fe - Iron	75.7821	75.2851	75.6478
Co - Cobalt	1.1599	1.1953	1.1648
Mn - Manganese	0.0594	0.0617	0.0572
Zr - Zirconium	0.0000	0.0000	0.0000
TOTAL TRANSITION METALS	77.0013	76.5421	76.8699
Metalloids (atomic percent)			
B - Boron	5.9251	6.0371	5.9704
Mg - Magnesium	0.0027	0.0026	0.0026
Ga - Gallium	0.0281	0.0257	0.0276
Al - Aluminum	0.5487	0.5572	0.5683
Ca - Calcium	0.0065	0.0080	0.0096
Na - Sodium	0.0284	0.0362	0.0307
TOTAL METALLOIDS	6.5394	6.6668	6.6093
Others (atomic percent)			
O - Oxygen	0.9918	0.7654	0.6432
N - Nitrogen	0.8162	0.8281	0.9174
C - Carbon	0.1075	0.1358	0.1271
S - Sulfur	0.0002	0.0002	0.0002
TOTAL OTHERS	1.9158	1.7295	1.6879
INTRINSIC COERCIVITY (kOe)	16.1	15.0	17.6
ENERGY PRODUCT (MGOe)	36.2	36.2	28.8
REMANENCE (kiloGauss)	12.5	12.4	11.0

SUMMARY OF TEST RESULTS	High End (sample D) ZSCC-225-021D	High End (sample E) ZSCC-225-021E	High End (sample F) ZSCC-225-021F
Rare Earths (atomic percent)			
Gd - Gadolinium	0.0125	0.0284	0.0274
Dy - Dysprosium	0.7792	1.9148	1.8892
Pr - Praseodymium	0.0849	0.0885	0.0998
Nd - Neodymium	13.9562	12.0604	13.2888
La - Lanthanum	0.0268	0.0230	0.0252
Ce - Cerium	0.0130	0.0152	0.0154
Sm - Samarium	0.0112	0.0098	0.0107
TOTAL RARE EARTHS	14.8837	14.1401	15.3565
Transition Metals (atomic pct.)			
Fe - Iron	75.1993	77.1189	75.3111
Co - Cobalt	1.1706	0.0995	0.0993
Mn - Manganese	0.0541	0.0595	0.0563
Zr - Zirconium	0.0000	0.0000	0.0000
TOTAL TRANSITION METALS	76.4240	77.2779	75.4668
Metalloids (atomic percent)			
B - Boron	5.9254	5.9380	6.0759
Mg - Magnesium	0.0056	0.0082	0.0055
Ga - Gallium	0.0184	0.0239	0.0232
Al - Aluminum	0.5134	0.5435	0.5487
Ca - Calcium	0.0185	0.0233	0.0168
Na - Sodium	0.0294	0.0261	0.0263
TOTAL METALLOIDS	6.5107	6.5630	6.6964
Others (atomic percent)			
O - Oxygen	0.9248	0.9978	0.6115
N - Nitrogen	1.1264	0.7927	1.7473
C - Carbon	0.1283	0.2264	0.1193
S - Sulfur	0.0021	0.0021	0.0021
TOTAL OTHERS	2.1816	2.0190	2.4803
INTRIN. COERCIVITY (kOe)	16.0	22.3	20.4
ENERGY PRODUCT (MGOe)	33.8	31.2	31.4
REMANENCE (kiloGauss)	11.9	11.4	11.4

SUMMARY OF TEST RESULTS	High End (sample G) ZSCC-225-021G	High End (sample H) ZSCC-225-021H	High End (sample I) ZSCC-225-021I
Rare Earths (atomic percent)			
Gd - Gadolinium	0.0287	0.0111	0.0069
Dy - Dysprosium	1.9240	0.6700	0.4065
Pr - Praseodymium	0.0782	0.1088	0.1117
Nd - Neodymium	12.1508	13.8794	14.4511
La - Lanthanum	0.0227	0.0261	0.0273
Ce - Cerium	0.0161	0.0158	0.0184
Sm - Samarium	0.0094	0.0112	0.0122
TOTAL RARE EARTHS	14.2299	14.7225	15.0341
Transition Metals (atomic pct.)			
Fe - Iron	77.3637	75.1601	76.4207
Co - Cobalt	0.1017	0.5979	0.1059
Mn - Manganese	0.0375	0.0563	0.0556
Zr - Zirconium	0.0000	0.0000	0.0000
TOTAL TRANSITION METALS	77.5029	75.8143	76.5821
Metalloids (atomic percent)			
B - Boron	5.8904	5.7108	5.8032
Mg - Magnesium	0.0027	0.0055	0.0056
Ga - Gallium	0.0250	0.0183	0.0185
Al - Aluminum	0.5637	0.5334	0.5052
Ca - Calcium	0.0048	0.0151	0.0237
Na - Sodium	0.0252	0.0293	0.0295
TOTAL METALLOIDS	6.5118	6.3123	6.3857
Others (atomic percent)			
O - Oxygen	0.9873	2.0082	1.1156
N - Nitrogen	0.6542	0.9866	0.7223
C - Carbon	0.1138	0.1540	0.1581
S - Sulfur	0.0002	0.0021	0.0021
TOTAL OTHERS	1.7554	3.1509	1.9981
INTRINS. COERCIVITY (kOe)	21.8	16.2	13.0
ENERGY PRODUCT (MGOe)	32.2	36.3	32.8
REMANENCE (kiloGauss)	11.7	12.4	11.8

SUMMARY TEST RESULTS	A.R.E. ZSCC-225-014	NEOCO ZSCC-225-022A	AIWA ZSCC-225-025	GEC ZSCC-225-026
Rare Earths (atomic percent)				
Gd - Gadolinium	0.0155	0.0143	0.0195	0.0117
Dy - Dysprosium	0.5614	0.5481	1.2993	0.6949
Pr - Praseodymium	0.8178	6.7891	0.1170	0.2437
Nd - Neodymium	13.2327	7.1665	13.2946	13.7467
La - Lanthanum	0.2274	0.0395	0.0262	0.0497
Ce - Cerium	0.0128	0.0462	0.0137	0.0192
Sm - Samarium	0.0000	0.0000	0.0094	0.0073
TOTAL RARE EARTHS	14.8677	14.6037	14.7798	14.7731
Transition Metals (atomic pct.)				
Fe - Iron	75.4712	74.4668	75.5657	77.8853
Co - Cobalt	0.1002	0.0962	1.6194	0.1109
Mn - Manganese	0.1800	0.1712	0.2385	0.1501
Zr - Zirconium	0.0000	0.0034	0.0000	0.0000
TOTAL TRANSITION METALS	75.7514	74.7376	77.4236	78.1464
Metalloids (atomic percent)				
B - Boron	6.1647	6.4940	6.9481	6.0367
Mg - Magnesium	0.0000	0.0000	0.0000	0.0000
Ga - Gallium	0.0111	0.0205	0.0238	0.0219
Al - Aluminum	1.4086	1.0065	0.7937	0.9896
Ca - Calcium	0.0016	0.0031	0.0032	0.0030
Na - Sodium	0.0279	0.0135	0.0278	0.0292
TOTAL METALLOIDS	7.6139	7.5377	7.7966	7.0805
Others (atomic percent)				
O - Oxygen	1.1809	2.9066	0.0000	0.0000
N - Nitrogen	0.0284	0.1829	0.0000	0.0000
C - Carbon	0.5522	0.0296	0.0000	0.0000
S - Sulfur	0.0056	0.0019	0.0000	0.0000
TOTAL OTHERS	1.7671	3.1209	0.0000	0.0000
INTRIN. COERCIVITY (kOe)	12.8	13.2	>14.0	>10.0
ENERGY PRODUCT (MGOe)	31.4	31.2	N/A	N/A
REMANENCE (kiloGauss)	11.8	11.8	N/A	N/A

265. Respondent NEOCO sent samples of its own magnets to Larry Jones at the Ames Laboratory for testing. (RXN-96 at 3-4). NEOCO's samples included six magnets identified as "Sample B." (RXN-100 at 3). All of the NEOCO magnets in Sample B were the same and had the same dimensions. (RXN-100 at 3).

266. The tests performed at Ames Laboratory showed that the magnets in NEOCO's Sample B contained the following chemical elements: (i) 14.2 atomic percent rare-earths, nearly all of which was comprised of neodymium and praseodymium; (ii) 79.6 atomic percent transition metals, nearly all of which was iron mixed with small amounts of cobalt; and (iii) 6.2 atomic percent boron. (Bohlmann, Tr. at 1710-11, 1712, 1829-30).

267. The Ames Laboratory test results show that NEOCO's Sample B magnets are sintered anisotropic magnets having the following magnetic properties: (i) an intrinsic coercivity in excess of 13,000 Oersteds; (ii) a remanence in excess of 11,000 Gauss; and (iii) an energy product in excess of 25 megaGaussOersteds. (Bohlmann, Tr. at 1706-09, 1713-16, 1748-49).

268. The tests performed at Ames Laboratory showed that the "2-14-1 phase" is the predominant phase in the magnets in NEOCO's Sample B. (Bohlmann, Tr. at 1713-14).

269. According to NEOCO's expert Mr. Bohlmann, the fact that the predominant phase in NEOCO's Sample B magnets is the 2-14-1 phase means that the magnets probably have lattice constants of "a_0" and "c_0" of 8.8 angstroms and 12 angstroms, respectively, even though the Ames Laboratory did not measure the lattice constants. (Bohlmann, Tr. at 1724-26).

270. With respect to claim 1 of the '058 patent, each of the third-party magnets obtained from AIWA and GEC: (i) has an intrinsic coercivity in excess of 1,000 Oersteds,

and thus is a "magnetically hard alloy composition," as that term is defined in the '058 patent; (ii) contains a total amount of neodymium and praseodymium of about 14 atomic percent, which lies within the claimed range from at least about 10 to about 40 atomic percent; (iii) contains about 75.5-77.9 atomic percent iron, which lies within the claimed range from at least about 50 to about 90 atomic percent; and (iv) contains about 6.0-6.9 atomic percent boron, which lies within the claimed range from about 0.5 to 10 atomic percent. (Guruswamy, Tr. at 636-38; CX-49, Tabs 18, 19). Thus, the two magnets obtained from the products of third-parties AIWA and GEC infringe claim 1 of the '058 patent. (Guruswamy, Tr. at 638).

271. With respect to claim 13 of the '395 patent, each of the third-party magnets: (i) has an intrinsic coercivity in excess of 5,000 Oersteds; (ii) is a "permanent magnet," since its intrinsic coercivity exceeds 1,000 Oersteds; (iii) contains iron, neodymium and praseodymium, as required by claim 13 of the '395 patent. (Guruswamy, Tr. at 639; CX-49, tabs 18, 19). Thus, each of the magnets obtained from products manufactured by third-parties AIWA and GEC infringes claim 13 of the '395 patent. (Guruswamy, Tr. at 640).

XVII. Prior Art

272. One of ordinary skill in the magnetic art would have to have a minimum of a college degree or equivalent qualification, <u>i.e.</u>, extensive work experience in, solid state physics, materials, and engineering. (Guruswamy, Tr. at 333-335).

273. A Koon 1980 abstract (RXN-51) reads:

> CD-4 NEW CLASS OF MELT-QUENCHED AMORPHOUS ALLOYS
> N.C. Koon, C.M. Williams and B.N. Des, Naval Research Laboratory,
> Washington, DC 20375 [Koon 1980 abstract]

The amount of rare earth which can be added to melt-quenched amorphous alloys such as $Fe_{.82}B_{.18}$ is limited in part by the formation of stable rare earth-iron intermetallic compounds. We have found that the addition of La tends to suppress the formation of such compounds and greatly increases the amount of rare earth which can be added while retaining the amorphous melt-quenched state. Some of the resulting alloys have interesting magnetic and hysteretic properties, especially after recrystallization in a magnetic filed. For partially recrystallized $(Fe_{.82}B_{.18})_{.9}Tb_{.05}La_{.05}$. as an example, we measured a coercive field of 7.3 kOe and a maximum (BM) product of 10.5 MC–Oe at room temperature, with the coercive field increasing to over 20 kOe at 4.2K. Magnetization date on this and related alloys in both the amorphous and partially recrystallized state will be presented.

274. Koon U.S. Patent No. 4,402,770 ('770 patent) (CX-18, Tab 20) titled "Hard Magnetic Alloys Of A Transition Metal and Lanthanide" is based on Ser. No. 314,325 filed Oct. 23, 1981. The patent issued on Sept. 6, 1983. The invention of the '770 patent pertains generally to hard magnetic alloys comprising iron, boron and lanthanides. (Col. 1, lines 6-9). The patent discloses that the objects of the invention are achieved by heating an amorphous alloy comprising iron, boron, lanthanum, and a lanthanide until a polycrystalline multi-phase alloy with a grain size small enough to be a single-domain particle is formed. (Col. 2, lines 7-12). The '770 patent discloses that (col. 2, lines 39-50):

> Any lanthanide can be used [in the polycrystalline single-domain alloys of Koon's invention] but, many have poor magnetic properties, are expensive, or are difficult to process. These nonpreferred lanthanides are cerium, praseodymium, neodymium, europium gadolinium, ytterbium, and lutetium. An iron-boron alloy with only lanthanum is not preferred as a hard magnet because of poor magnetic properties. The most preferred lanthanides are terbium, dysprosium, holmium and erbium. It is possible to alloy iron and boron with the lighter lanthanides (Ce, Pr, Nd) in concentrations of less than two atomic percent.

275. Koon U.S. Patent No. 4,409,043 ('043 patent) titled "Amorphous Transition Metal-Lanthamide Alloys" issued on October 11, 1983 and is based on U.S. Ser. No. 314,326 filed October 23, 1981. (CX-18, Tab 20). The '043 patent discloses that the attractiveness of amorphous alloys for certain applications is due, in part, to the fact that a material that lacks a regular crystal structure cannot have conventional magnetic anisotropy. (Col. 1, lines 41-45). Table 1 of the '043 patent (col. 5) reads:

TABLE I

Alloy	Crystalline	Border-line	Amorphous
$Co_{.82}B_{.18}$			x
$Fe_{.82}B_{.18}$			x
$Co_{.74}B_{.06}B_{.20}$			x
$(Fe_{.82}B_{.18})_{.95}Tb_{.05}$	x		
$(Co_{.74}Fe_{.06}B_{.20})_{.98}Sm_{.02}$	x		
$(Fe_{.82}B_{.18})_{.99}Tb_{.01}$		x	
$(Fe_{.82}B_{.18})_{.99}Sm_{.02}$		x	
$(Fe_{.82}B_{.18})_{.95}La_{.05}$			x
$(Fe_{.82}B_{.18})_{.90}La_{.10}$			x
$(Fe_{.82}B_{.18})_{.9}Tb_{.05}La_{.05}$			x
$(Fe_{.82}B_{.18})_{.95}Tb_{.03}La_{.02}$			x
$(Co_{.74}Fe_{.06}B_{.20})_{.95}Sm_{.02}La_{.03}$			x
$(Fe_{.82}B_{.18})_{.93}Tb_{.05}La_{.02}$			x
$(Fe_{.85}B_{.15})_{.90}Tb_{.05}La_{.05}$			x
$(Fe_{.82}B_{.18})_{.9}D_{y.05}La_{.05}$			x
$(Fe_{.82}B_{.18})_{.9}Sm_{.05}La_{.05}$			x
$((Fe_{.82}B_{.18})_{.9}Tb_{.05}La_{.05})_{.98}C_{.02}$			x

276. Koon U.S. Patent No. 4,533,408 ('408 patent) (RXN-104) is based on Ser. No. 529,728 filed Sept. 6, 1983. The patent issued on Aug. 6, 1985. Ser. No. 529,728 is a continuation-in-part of Ser. No. 314,325 filed Oct. 23, 1981. It contains twenty claims. In contrast to the '770 patent, the '408 patent contains the following new matter, <u>inter alia</u> (col.

2, lines 14-25):

> These and other objects are achieved by alloying a transition metal, boron, at least one lower-weight lanthanide having none or few stable compounds with iron, optionally one or more higher-weight lanthanides, a glass former, and optionally the pseudo lanthanide, yttrium; forming an amorphous or nearly amorphous metastable microstructure in the alloy; and heating the amorphous alloy to form a polycrystalline, multiphase, fine-grain single-domain structure. Magnetization is imported during or after heating by exposing the alloy to a magnetic field.

The lower-weight lanthanide is selected from the group consisting of lanthamium, cerium, praseodymium, neodymium and samarium. (RXN-104, col. 2 lines 62-65).

277. Koon reissue patent Re 34, 322 is based on Ser. No. 304,150 filed Jan. 31, 1989. (RXN-134). It issued on July 27, 1993 and is a reissue of the '408 patent, adding one independent and six dependent new claims to the '408 patent. New independent claim 26 reads:

> 26. A method of preparing a hard magnetic polycrystalline alloy which comprise the steps of preparing an alloy represented by the formula:
>
> $$(M_wX_xB_{1-w-x})_{-1-y}(Y_rR'_2L_{1-v-z})_y$$
>
> wherein v is from ˉ0 to 0.8, w is from about 0.7 to about 0.98; x is from 0 to about 0.15; y is from about 0.05 to about 0.25; z is from 0 to about 0.95; M is selected from the class consisting of iron, cobalt, an iron-cobalt alloy, an iron-cobalt alloy, an iron-maganamese alloy having at least 50 atomic percent iron, an iron-cobalt-manganese alloy having at least 50 atomic percent iron and cobalt, X is an auxilliary glass former selected from the class consisting of phosphorous, silicon, aluminum, arsenic, germanium, indium, antimony, bismuth, tin and mixtures thereof, R' is a heavier-weight lanthanide selected from the group consisting of europium and lanthanides heavier than europium

and L is a mixture of lanthanum and an amount of a lighter weight lanthanide selected from the group consisting of praseodymium and neodymium effective to enhance the magnetic properties of said alloy, said alloy having a polycrystalline, multiphase, single-domain microstructure wherein the average crystal-grain size does not exceed 400A; creating an amorphous microstructure is said alloy; and heating said alloy at a temperature from about 850 to 1200 K in a magnetic field of at least one kOe until a polycrystalline microstructure is obtained.

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282. Koon filed Ser. No. 248,217 on September 23, 1988 which is a reissue

application of the '770 patent. (RXN-82). In the declaration of Koon with the reissue application, Koon stated (RXN-137):

> I believe that the original patent [the '770 patent] is partly inoperative by reason of a defective specification. The defect appears in the language at column 2, lines 44 through 50 which can be misinterpreted to limit the scope of my specification and render the claims wholly or partially invalid.
>
> Particularly, it has come to my attention that the sentence which says, "It is possible to alloy iron and boron with the lighter lanthanides (Ce, Pr, Nd) in concentrations of less than two atomic percent." (starting at column 2, line 48) has been construed to mean that the total amount of these lighter rare earth elements must be less than 2 atomic percent of the alloy regardless of whether or not lanthanum is present. By lighter rare earth elements, I mean those rare earth elements with an atomic number and weight less than that of gadolinium, i.e. the lighter half of the lanthanide series.
>
> Also, I believe that the original patent is partly inoperative because I claimed less than I was entitled to claim. Particularly, the original patent does not contain sub-genus and species claims specifically claiming combinations including the lighter rare earths which I am entitled to claim. These subgenus and species claims are supported by the specification and are within the scope of claim 1 of my original patent.
>
> I believe the partial inoperativeness of the specification and claims occurred without any deceptive intent during the rush to file three related applications before the first anniversary of my presentation of the subject matter of the applications at the Twenty Sixth Annual Conference on Magnetism and Magnetic Materials held in Dallas, Texas, November 11-14, 1980. One of those applications matured into the original patent 4,402,770 ('770) which is the subject of this reissue application.
>
> An abstract of my presentation was published in the program of the conference. The text of the presentation was published in the November 15, 1981 issue of Applied Physics Letters, Volume 39

(10) at pages 840-842.

After the Dallas meeting, I submitted three invention disclosures to the patent counsel's office at the Naval Research Laboratory relating to different aspects of the subject matter that I disclosed. Relatively close to the first anniversary of the conference, I was contacted by Thomas E. McDonnell, a Navy patent attorney from another Naval installation, regarding those disclosures, and, in a relatively short period of time, we prepared and filed three patent applications relating to my discovery.

At the time the three applications were prepared, I believed that the lighter rare earth elements could be added to the alloy in amounts ranging up to 2 atomic percent and more for some of the light rare earth elements without lanthanum being present. Further, an amount up to 14.25 atomic percent of rare earth elements, including lighter rare earth elements, could be alloyed if at least .75 atomic percent of lanthanum were present. I thought these beliefs were unambiguously expressed in the specifications of the three applications being prepared together. In the '770 Patent these concepts are expressed in the sentence starting at column 2, line 48 and column 2, line 20-28. This is confirmed by comparing that sentence to the sentence expressing the same teachings in slightly different words at column 2,lines 38-41 of the concurrently filed "soft" magnet patent 4,409,043 incorporated by reference at column 4 line 29 of the '770 patent. The soft patent describes the preparation of the precursor soft magnets of the hard magnets of this invention.

In recent months, as the licensing of the original patent has been explored, it has come to my attention that the meaning and intent of the above cited language may not be as clear and unambiguous as I thought it was during the time I was assisting in the preparation of the application. I have come to realize that the minor differences in the wording of what I thought were expressions of the same concept are being construed as being directed to different concepts.

Included in the reissue application were the following additional claims 23 to 31 which claims are not found in any earlier Koon application:

23. The alloy of Claim 1 wherein R is a lanthanide selected the group consisting of praseodymium, neodymium samarium and mixtures thereof.

24. The alloy of Claim 23 wherein M is iron and x is zero.

25. The alloy of Claim 23 wherein R is a lanthanide selected from the group consisting of praseodymium, neodymium samarium and mixtures thereof.

26. The alloy of Claim 25 wherein M is iron and x is zero.

27. The alloy of Claim 23 wherein R is neodymium.

28. The alloy of Claim 27 wherein M is iron and x is zero.

29. The alloy of Claim 27 that is represented by the formula: $((Fe_{0.3}Co_{0.3}Mn_{0.2})_{0.7}B_{0.3})_{0.9}(Nd_{0.5}La_{0.5})_{0.1}$

30. The alloy of Claim 21 wherein R is praseodymium.

31. The alloy of Claim 28 wherein M is iron and x is zero.

283. A Koon 1981 abstract titled "Abstract: A new class of melt quenched amorphous magnetic alloys" by N.C. Koons, C.M. Williams and B.N. Das (RXN-18) read:

> We have succeeded in producing a new class of melt quenched amorphous alloys which combine a strongly magnetic transition metal-metalloid type glass such as $Fe_{.87}B_{.18}$ with a substantial amount of rare earth (up to 10-15 at .%). This was accomplished by the discovery that La, which has no stable compounds with iron, inhibits the formation of intermetallic compounds during the quench process. The addition of just 2 at .% La to $Fe_{.82}B_{.18}$, for example, raises the amount of Tb while can be added from approximately 1 at .% to over 6 at .%, which still maintaining the amorphous meltquenched state. The addition of Tb is predicted to increase the isotropic magnetostriction by approximately 30 $x10^{-6}$/at % Tb. In the crystallized state we have also shown that it is possible to produce alloys with very high coercive forces. For $(Fe_{.82}B_{.18})_{.9}Tb_{.05}La_{.05}$, as an example,

we found Br = 4.8 kG and iHc of up to 10 kOe at room temperature.

284. A 1981 article by Koon *et al.* entitled "Magnetic properties of amorphous and crystallized $(Fe_{0.82}B_{0.18})_{0.9}Tb_{0.05}La_{0.05}$," Appl. Phys. Lett. 39(10), pp. 840-842 (1981), (1981 article) describes the same terbium alloy as that described in the Koon 1980 abstract and the Koon 1981 abstract. (RXN-56; RXN-51; RXN-18).

285. The Koon 1981 article (RXN-56) which was received on July 10, 1981, accepted for publication on September 4, 1981 and published in Appl. Phys. Lett. 39(10) on November 15, 1981 has an abstract. The abstract reads:

> The magnetic properties of $(Fe_{0.82}B_{0.18})_{0.9}Tb_{0.05}La_{0.05}$ in both the amorphous and crystallized states are presented. When amorphous, the alloy is magnetically soft and has a low coercive force, comparable to the corresponding alloy without rare earths. Upon annealing near the crystallization temperature of 900 K, however, the intrinsic coercive force at 300 K rises to 9 kOe, with a remanent magnetization of slightly less than 5 kG. In the amorphous state this and related alloys appear to have potential for use in devices requiring large, isotropic magnetostriction, while in the crystallized state they appear potentially useful as low cobalt permanent magnets.

286. An Invention Disclosure of N.C. Koon dated June 19, 1981 (RXN-105) sets forth a formula:

$(TM_xG_{1-x})_{1-y}(R_zLa_{1-z})_y$

TM = Fe, Co or Mn.

G = B (with some addition of other glass formers such as P, C, Si, Al)

R_z = any of the rare earth elements or combinations thereof. (RXN-105 § 3 p. 3)

287. The invention disclosure discloses only one specific alloy which is the terbium alloy disclosed in the Koon 1980 abstract. (RXN-105).

288. U.S. Patent No. 3,615,911 (the '911 patent) issued on October 26, 1971 to Ethan A. Nesbitt, Jack H. Scaff and Henry C. Theuerer. (CX-448).

289. The Nesbitt '911 patent was considered by the Examiner in the U.S.P.T.O. during the prosecution of the '395 patent and the asserted claims of the '395 patent were allowed over the Nesbitt '911 patent. (CX-3; CX-23, Tab 8).

290. The Nesbitt '911 patent is generally directed to a method for sputtering magnetic films containing cobalt, samarium and sometimes copper. The only examples in the '911 patent are for cobalt-samarium and cobalt-samarium-copper magnetic films. (CX-448; Bohlmann, Tr. at 1461-63; CX-442, Q. 59).

291. NEOCO's expert, Bohlmann admitted that the Nesbitt '911 patent is directed to a way of making thin films of samarium-cobalt having improved magnetic properties. (Bohlmann, Tr. at 1462-63).

292. NEOCO's expert, Bohlmann admitted that the Nesbitt '911 patent does not describe the coercivities of the samarium-cobalt films. (Bohlmann, Tr. at 1465-66).

293. NEOCO's expert Bohlmann admitted that the Nesbitt '911 patent does not disclose neodymium and/or praseodymium-iron compositions such as those set forth in the asserted claims of the '395 patent although he did make reference to the disclosure in the '911 patent (CX-448) that rare earths including praseodymium and neodymium may be used in sputtered layers and such layers have been obtained with samarium, cerium and praseodymium in

that order and those rare earth elements are preferred. (Bohlmann, Tr. at 1464-65).

294. There is no description in the Nesbitt '911 patent of the compositions set forth in the claims in issue of the '395 patent, which are directed to permanent magnets or permanent magnet alloys (1) containing (i) neodymium and/or praseodymium and (ii) iron and (2) having an inherent intrinsic coercivity of at least 5,000 Oersteds at room temperature. (CX-448; CX-442, Q. 59; Bohlmann, Tr. at 1464-65).

295. U.S. Patent No. 3,560,200 (the '200 patent) issued on February 2, 1971 to Ethan A. Nesbitt, Jack H. Wermick and Ronald H. Willens. (CX-447).

296. The Nesbitt '200 patent was before the Examiner in the PTO during the prosecution of the '395 patent and is referred to on the first page of the '395 patent under the heading "Referenes cited- U.S. Patent Documents" (CX-3; CX-442, Q. 55; CX-447; Bohlmann, Tr. at 1456-57).

297. The Nesbitt '200 patent was considered by the Examiner in the PTO during the prosecution of the '395 patent, and the claims in issue of the '395 patent were allowed over the Nesbitt '200 patent. (CX-3; CX-23, Tab 8).

298. The Nesbitt '200 patent is generally directed to copper-containing alloys which include constituents from three groups of elements: (1) cobalt and/or iron; (2) copper, nickel, aluminum or mixtures thereof; and (3) rare-earth elements. (CX-447; Bohlmann, Tr. at 1345-46).

299. The Nesbitt `200 patent teaches that cobalt (Co) is preferred over iron (Fe) and that the inclusion of copper (Cu) is critical to the invention. (Bohlmann, Tr. at 1435-38; CX-447).

300. The only examples in the Nesbitt '200 patent show alloys containing copper, cobalt, samarium or cerium. (CX-447; CX-442, Q. 59).

301. NEOCO's expert Bohlmann admitted that the only examples in the Nesbitt '200 patent all include cobalt (not iron), copper and samarium or cerium. (Bohlmann, Tr. at 1437).

302. The Nesbitt '200 patent states that since cobalt and/or iron provide the main magnetic contribution and that the rare-earth contribution is largely anti-ferromagnetic, the rare-earth component in its alloy can be replaced by other elements such as calcium, strontium or barium. (Bohlmann, Tr. at 1439-49; CX-447 at col. 7, lines 14-22).

303. NEOCO's expert Bohlmann, admitted that the Nesbitt '200 patent does not describe or suggest neodymium and/or praseodymium-iron compositions or the preparation of such compositions. (Bohlmann, Tr. at 1441).

304. NEOCO's expert Bohlmann admitted that the Nesbitt '200 patent does not describe or suggest the use of neodymium and/or praseodymium ahead of any other rare earths. (Bohlmann at 1459).

305. There is no description in the Nesbitt '200 patent of the compositions set forth in the claims in issue of the '395 patent, which are directed to permanent magnets or permanent magnet alloys (1) containing (i) neodymium and/or praseodymium and (ii) iron and (2) having an inherent intrinsic coercivity of at least 5,000 Oersteds at room temperature. (CX-448; CX-442, Q. 59).

306. In IEEE Transactions On Magnetics at 659-663 (September 1971) there was published an article titled "Theoretical and Experimental Aspects of Coercivity Versus Particle

Size for Barium Ferrits" by B. Thomas Shirk and W. R. Buessen (the Shirk article). (RXN-13).

307. The Shirk article only describes methods of making barium ferrite compositions. The Shirk article does not relate to rare-earth magnets or magnetic materials, let alone ones containing neodymium and/or praseodymium and iron and having intrinsic coercivities of at least 5,000 Oersteds, as required by the claims in issue of the '395 patent. (RXN-13; CX-442, Q. 59; Bohlmann, Tr. at 1471-73).

308. NEOCO's expert Bohlmann admitted that the Shirk article does not relate to compositions containing rare-earth elements. (Bohlmann, Tr. at 1471-72).

309. NEOCO's expert Bohlmann admitted that the Shirk article does not describe any neodymium and/or praseodymium-iron compositions. (Bohlmann, Tr. at 1473).

310. There is no description in the Shirk article of the compositions set forth in the claims in issue of the '395 patent. (CX-442, Q. 59).

311. U.S. Patent No. 3,421,889 (the '889 patent) issued on Jan. 14, 1969 to Werner Ostertag and Karl J. Strnat. (RXN-10).

312. The Ostertag '889 patent was before the Examiner in the PTO during the prosecution of the '395 patent and is referred to on the first page of the '395 patent under the heading "References Cited - U.S. Patent Documents." (CX-3; RXN-10; Bohlmann, Tr. at 1475-76).

313. The Ostertag '889 patent was considered by the Examiner in the PTO during the prosecution of the '395 patent, and the claims in issue of the '395 patent were allowed over the Ostertag '889 patent. (CX-3; CX-23, Tab 8).

314. The Ostertag '889 patent is directed to alloys having the formula R_2Co_{17}, where Co is cobalt and R is a rare-earth element. (RXN-10; Bohlmann, Tr. at 1479-80).

315. There is no description or suggestion in the Ostertag '889 patent of a composition of neodymium and/or praseodymium and iron having a coercivity greater than 5,000 Oersteds. (RXN-10).

316. NEOCO's expert Bohlmann admitted that the Ostertag '889 patent does not describe or suggest the use of neodymium and/or praseodymium over other rare-earth elements. (Bohlmann, Tr. at 1488).

317. NEOCO's expert Bohlmann admitted that the Ostertag '889 patent does not describe or suggest neodymium and/or praseodymium-iron magnet compositions, much less such compositions having a coercivity greater than 5,000 Oersteds. (Bohlmann, Tr. at 1481).

318. A Drozzina article was published in Nature No. 3401, Vol. 135 on January 5, 1935 titled "A New Magnetic Alloy with Large Coercive Force" by V. Drozzina and R. James (Drozzina article) (RXN-30). It reports investigating the magnetic properties of a sample of metallic neodymium containing about 7 percent of iron which was lent to the authors by Prof. H Hopkins of Illinois. The sample was "strangely" ferromagnetic. Its specific magnetization in a field of 20,000 Oersted is about "13[?]" at room temperature. It was difficult for the authors to assert whether they were dealing with a homogeneous alloy of iron and neodymium or whether the finely dispersed iron is imbedded among neodymium grains. The authors did report:

> The value of the specific magnetization seems to correspond to

> about 7 per cent free iron. Yet the material investigated by us shows an extraordinarily great coercive force, reading 4,300 Oersted with a remanent magnetization equal to 70 per cent of the maximal temporary value. This enormous coercive force, so far as we know, has never been observed either in pure iron or in any of its alloys. Thus we may conclude that these remarkable magnetic properties are due to a hitherto unknown iron alloy.

319. NEOCO's Bohlmann testified that prior to about 1960 rare-earth were available generally as a mixture of rare-earths (Tr. at 1482) although he believed that laboratory scientists would have access to high purity rare earth many years before 1960. (Tr. at 1518).

320. The Drozzina article does not state whether the 7 percent iron is 7 atomic percent iron or 7 weight percent iron. (RXN-30; Bohlmann, Tr. at 1521).

321. Bozorth, "Ferromagnetism," Van Nostrand Co. (1959) (RXN-7) (Bozorth reference) mentions and summarizes the Drozzina article (RXN-30). The Bozorth reference inaccurately states that the coercive force observed by the authors of the Drozzina article was 4600 Oersteds instead of the actual 4300 Oersteds. (RXN-7, RXN-30). The Bozorth reference states that the composition and one of the magnetic properties of the material referred to in the Drozzina article are uncertain because of inconsistencies in the Drozzina article. (RXN-7).

322. As to the term "alloy" and "compound", NEOCO's expert Bohlmann testified (Tr. at 1502 to 1506):

Q What is your understanding of the term "alloy"?

A It's a combination of metal elements.

Q It's not a mixture, it's a combination of elements?

A Yes, it would be a combination.

JUDGE LUCKERN: What's the difference between a combination of elements and a mixture of elements?

THE WITNESS: If iron and cobalt were simply mixed together, the iron and the cobalt would maintain their individual characteristics as an element. In the case of an alloy, the iron and cobalt combine in such a fashion that an alloy is formed which with characteristics are somewhat different from either iron or cobalt.

JUDGE LUCKERN: So it's sort of like – don't rely on my knowledge, I left the scientific field back in 1956, so – but is an alloy sort of like a compound, then, would you consider it anything like a compound, rather than a mixture?

THE WITNESS: Yes. The chemists will use the word "compound" and the metallurgist will use the word "alloy." And the word "alloy" is sometimes used as a verb instead of a noun.

JUDGE LUCKERN: Of course then unfortunately the lawyers get into the act, and I'm a lawyer also, I have a high regard for lawyers, and that may be, I think we have an a composition, sometimes we use – see these words composition, where does this word "composition" fit with in compound and alloy, compositions of matter. You're not a lawyer, I understand that, but as a technical man, does a composition of matter in this alloy field embrace an alloy or a mixture or would it cover both or do you know?

THE WITNESS: Composition, in my mind, I would think the word "composed of."

JUDGE LUCKERN: But is that composition of matter in the alloy field, is that a common term of art?

THE WITNESS: Yes. Composition would – would mean to imply there is a number of elements are involved, and they are some way combined either as an alloy or as a mixture, or some combination.

JUDGE LUCKERN: But is that composition of matter in the alloy field, is that a common term of art?

THE WITNESS: Yes. Composition would – would mean to imply there is a number of elements are involved, and they are some way combined either as an alloy or as a mixture, or some combination.

JUDGE LUCKERN: All right. Go ahead, Mr. Poissant.

BY MR. POISSANT:

Q Let's stay with that for a second, Mr. Bohlmann. You indicated that an alloy is analogous to a compound in chemistry?

A Yes, it can be. Yes.

Q And that's where two elements, two chemical elements actually react together to form a new compound, so to speak?

A Yes, that's one way of understanding it, yes.

Q So in metallurgy, the comparable analogy is that two metal elements react together to form an alloy or a new compound?

A Yes.

Q And that's opposed to what would be a simply a physical mixture of two metallic compounds?

A Yes.

Q Okay. Now, if there's a physical mixture, there would be as I understand it, and correct me if I'm wrong here, there would be, you know, one phase would be one of the - - one of the elements and another phase would be another elements?

A Yes.

Q So there would be more than one phase?

A Yes.

Q And that would be as distinguished from an alloy where there would be only one phase and it would be this – these compounded resulted when these two elements reacted together, right?

A Yes.

Q Okay. Now, would you look at the material in RXN 7 or what Mr. Bozarth [sic] had to say about this iron-neodymium compound of Drozzina and Janus. By the way, they were Russians, right?

A Russians or one of the – one of the former Soviet Union nations; I don't remember exactly.

Q So this article, which we haven't gotten to yet, dealt with supposedly some work that was done by these two individuals in Russia, right?

A Yes.

Q And that was in 1935, correct?

A Yes.

Q Okay. Let's look at what Mr. Bozarth [sic] has to say about this. Now, in the second full sentence, he indicates and I quote: It was not determined whether it contained one or more phases but possibly was one phase, one phase was iron or a solid solution of neodymium in iron, unquote. Isn't Mr. Bozarth [sic] indicating here that it was unknown whether or not they had a mixture as opposed to an alloy?

A No. I believe that's Mr. Bozarth [sic] is assuming that they had an alloy or several alloys represented by several phases.

Q Mr. –

A It contained one or more phases and a phase would certainly be an alloy.

JUDGE LUCKEN: Can an alloy have two phases?

THE WITNESS: Oh, yes.

JUDGE LUCKERN: And alloy can have three phases?

THE WITNESS: Yes.

JUDGE LUCKERN: So a multiplicity of phases is not limited to a mixture?

THE WITNESS: That's correct.

THE LUCKERN: Okay. Go ahead, Mr. Poissant.

BY MR. POISSANT:

Q One characteristic of a mixture is the fact that the mixture would exhibit the properties associated with one of the elements?

A Yes.

Q So to speak, if I had just - - let me try to simplify this. If I had a mixture of A and B, the properties I measured may be the properties exhibited by A or the properties exhibited by B but they would not be the properties exhibited by the combination of A or B; is that correct?

A Yeah.

Complainants' expert James testified as to mixture in contrast to an alloy (Tr. at 1858 to 1860):

Q Could you, about halfway through this publication [RXN-30] in the second full paragraph, there's a statement that, and I quote: The value of the specific magnetization seems to correspond to about seven percent of free iron. Do you see that, sir?

A I do.

Q What is your understanding of that statement?

A I would gather that that suggests that this is indeed a mixture, because that happens to be fortuitously the specific magnetization of free iron but only of free iron but free iron corresponding to seven percent.

Q And seven percent is the amount of iron that's purported to be in this composition?

A That is correct. But I don't know if that's seven weight percent or seven atomic percent or seven volume percent, there's no statement made.

Q You've indicated that this suggests a mixture, and that's to be contrasted with an alloy, Professor?

A That's correct. I would say there's not necessarily any atomic mixing, as I would put it, of the iron with the neodymium of some unknown - - with unknown impurities as well.

Q You could – the great coercitity force could be the result of these impurities and that might be present as a single phase or multiphases.

Q What is your understanding, Professor, of an alloy as opposed to a mixture?

A Well, a mixture would retain, say it's a binary and you have two elements, each of the elements would retain its identity after being prepared, after the mixture is prepared.

Q As opposed to an alloy?

A At [sic] opposed to an alloy, correct.

Q And what is your understanding of an alloy?

A An alloy is considered that [sic] there is an atomic mixture between the two elements in question which can result in solid solution, compound formation, et cetera.

Q Does this statement concerning that the magnetization seems to correspond to about sever percent of free iron, does that suggest the presence of a mixture rather than an alloy?

A That certainly does.

323. The Yahagi application, which is Japanese patent application No. 56-116844, was before the Examiner during prosecution of the '723 patent and is listed on the first page of the

'723 patent under "References Cited - Foreign Patent Documents." (CX-4; CX-442, Q. 69).

324. The Yahagi application was considered by the Examiner in the PTO during the prosecution of the '723 patent and the claims in issue of the '723 patent were allowed over the Yahagi application. (CX-4; CX-26, Tab 8).

325. The Yahagi application was before the Examiner during prosecution of the '368 patent and is listed on the first page of the '368 patent under "References Cited - Foreign Patent Documents". (CX-5; CX-442, Q. 80).

326. The Yahagi application was considered by the Examiner in the PTO during the prosecution of the '368 patent and the claims in issue of the '368 patent were allowed over the Yahagi application. (CX-5; CX-29, Tab 8).

327. The Yahagi application is directed to a method for preparing rare-earth magnets and illustrates rapid solidification techniques. (RXN-67; CX-442, Q. 74; Bohlmann Tr. at 1368-1370, 1673-74).

328. While Yahagi discloses heat treatment, it does not teach a sintering and does not teach any method as to how one arrives at a final magnet. (Bohlmann, Tr. at 1694).

329. With respect to the rare-earth element, the Yahagi application states that it can be "at least one element selected from rare-earth elements Sc, Y, La and elements of atomic number 58 to 71." This would include any rare-earth element. There is no express mention of neodymium or praseodymium, and there is no direction or indication to use neodymium and/or praseodymium in any specific amount. (RXN-67; CX-442, Q. 71; Bohlmann, Tr. at 1677-78).

330. The Yahagi application does not describe or suggest the use of neodymium and/or

praseodymium or the amounts of neodymium and/or praseodymium required by the asserted magnet claims of the '723 and '368 patents. (CX-442, Q. 71).

331. The Yahagi application also states that the rare-earth magnet contains "at least one metal selected from transition metals, such as Fe, Ni, Cr, Mn, Hf, Ti, Zr and the like . . ." This is a list of seven or more transition metals with no direction or indication to use any specific metal. (RXN-67; CX-442, Q. 71).

332. The Yahagi application does not describe or suggest the use of iron as the transition metal or the use of at least 56 atomic percent iron, as required in the asserted magnet claims of the '723 patent, or at least 62 atomic percent iron, as required in the asserted magnet claims of the '368 patent. (RXN-67; CX-442, Q. 71).

333. The Yahagi application also states in another part of the application that "In order to sufficiently promote the conversion into an amorphous state, one or more non-metallic elements such as P, B, C, Si, S, As, Se, Te and the like . . . may be added". This is just a list of at least eight "non-metallic elements". The Yahagi application does not require the use of any "non-metallic elements," let alone boron; rather it only states that they may be added to the mixture. (RXN-67; CX-442, Q. 71; Bohlmann, Tr. at 1678-79).

334. NEOCO's expert Bohlmann admitted that the Yahagi application states that the addition of nonmetallic elements is optional. (Bohlmann, Tr. at 1678-1679; RXN-67, pp. 2-3).

335. The claims in issue of the '723 and '368 patents require the presence of boron, together with the other recited elements. (CX-4; CX-5; Bohlmann, Tr. at 1664-66).

336. The Yahagi application contains two examples, both of which are directed to

samarium-cobalt magnets. (RXN-67).

337. There is no teaching in the Yahagi application that neodymium or praseodymium could be substituted for samarium in these examples, or that neodymium and/or praseodymium should be added to the examples in the amount used for samarium in the Yahagi application to produce compositions having the components and magnetic properties recited in the asserted magnet claims of the '723 and '368 patents. (RXN-67; CX-442, Q. 72 and Q. 73).

338. The only example of a composition disclosed in the Yahagi application that includes iron (a primarily samarium-cobalt magnet) uses only 20 weight percent (which corresponds to 24 atomic percent) of iron. This amount is well below the at least 56 atomic (not weight) percent iron required in the claims in issue of the '723 and the at least 62 atomic (not weight) percent iron required in the asserted magnet claims of the '368 patent. (RXN-67; CX-442, Q. 73).

339. The Yahagi application does not describe, suggest or enable the compositions set forth in the claims in issue of the '723 and '368 patents. The Yahagi application only describes a broad range of compositions that contain rare-earth elements, metals and possibly other non-metallic elements without any disclosure as to which ones or the amounts of these elements to use. (RXN-67; CX-442, Q. 74).

340. As to the Yahagi reference, Bohlmann testified (Tr. 1689-1691):

Q Now, having gone through the disclosures in this document - - and I believe you've reviewed this Yahagi reference carefully in connection with this action, right?

A Yes.

Q All right. - - you'd agree with me, Mr. Bohlmann, that there is absolutely no disclosure in here of a neodymium or praseodymium-iron-boron composition, right?

A Not specifically, only in the general.

Q Only in the general sense that there's a menu from which we can select various items, right?

A Yes.

Q And in fact, in order to arrive at that composition, we would have to go to the disclosure here which allows the use of any of the rare-earth metals, right?

A Yes.

Q Okay. And we would have to select from - - how many rare-earth metals are there, 15 or more?

A Yeah, 13, 15.

Q Quite a few. So in order to arrive at a neodymium-iron-boron - - neodymium or praseodymium, we would have to select from 15 or more rare-earth elements, right? And in order to arrive at the use of iron, we would have to select from the disclosure of I think seven or more transition metals, right?

A Yes.

Q And in order to arrive at the use of boron, we would have to select from eight or more identified nonmetallic elements?

A Yes.

Q And this disclosure specifically says as to those nonmetallic elements, that they're not required, that they are optional, correct?

A Yes. But as one skilled in the art, I would certainly prefer some elements over others, for example amongst transition magnet material, I would certainly select iron and/or cobalt as the first choice.

If I were looking for an element or two which would enable me to form a glassy compound, I would select boron and silicon as the choices.

With respect to the rare earths, as a practical matter, I would choose those which - - which would be economically available, and presuming of course that this patent has commercial interest, and so mischemetal would be the first choice, which is a mixture, if you will, of the - - mostly lighter rare-earth elements.

It may also contain a few of the heavier rare-earth elements. So if I were doing this work in 1980 or thereabouts, those would be choices of elements to try first.

Q There is nothing whatsoever in this document that describes this elaborate choices that you just went through, is there?

A No.

Q So there's nothing in this document that tells you to select one rare-earth over another rare-earth?

A Not in the document.

Q There's nothing in the document that tells you to select one transition metal over another transition metal?

A No, except that he used cobalt in the examples.

Q And there's nothing in the document that tells you to select one of the nonmetallic elements over any of the other eight plus listed nonmetallic elements?

A No.

Q And there's only one disclosure here of an example that uses iron and that's example two, right?

341. Without further guidance, which is absent from the Yahagi application, a person of ordinary skill in the art would have to test at least thousands of possible combinations before that

person might possibly find a mixture that might have the same composition, amounts and magnetic properties as the compositions set forth in the claims in issue of the '723 and '368 patents. This would involve undue experimentation to attempt to obtain the compositions described in these claims. (RXN-67; CX-442, Q. 74).

342. The Yahagi application does not describe or suggest that cobalt should be substituted for iron in an amount greater than 0 and not exceeding 25 atomic percent of the magnet as required by the claims in issue of the '368 patent. The Yahagi application also does not teach that such a magnet containing cobalt has a higher Curie temperature than a corresponding Fe-B-R based compound without cobalt as required by the asserted magnet claims of the '368 patent. (RXN-67; CX-442, Q. 82).

343. Sintering as generally applied to rare-earth permanent magnets does not describe the claims in issue of the '723 patent. (CX-442, Q. 75).

344. Sintering as applied to rare-earth permanent magnets does not suggest the claims in issue of the '368 patent. (CX-442, Q. 75 and Q. 82).

345. While a sintering process has been used in the magnet industry for decades (Bohlmann, Tr. at 1367 to 1368, 1371) this information does not describe to a person of ordinary skill in the art the magnets of the asserted claims of the '723 and '368 patents having the specified magnetic properties. (CX-442, Q. 75 and Q. 82).

346. The Yahagi application is directed to a method for preparing rare-earth magnets, not specific compositions. Therefore, it is not directed to particular compositions, since it is directed to a method. (RXN-67; CX-442, Q. 74; Bohlmann, Tr. at 1673-74).

347. Sintering as generally applied to rare-earth permanent magnets does not describe the invention of the claims in issue of the '651 patent. (CX-442, Q. 90).

XVIII. Secondary Considerations

348. There was a significant effort underway prior to 1984 to find a substitute for Sm-Co magnets. Particularly because of the political instability factor in Zaire, many firms and the United States government were actively engaged in research to identify a commercially viable substitute for Sm-Co magnets. (CX-456, Q. 10; CX-462, Q. 14).

349. For many applications, neodymium-iron-boron (Nd-Fe-B) magnets are an improvement over the types of magnets that were available on the market prior to 1984. (CX-456, Q. 8).

350. Prior to the advent of Nd-Fe-B magnets, the most powerful magnets on the market in terms of maximum energy product were samarium-cobalt ("Sm-Co") magnets. Nd-Fe-B magnets have two major advantages over Sm-Co magnets. First, the Nd-Fe-B magnets cover a broader range of energy products, and can achieve energy products higher than those seen in Sm-Co magnets. In addition, the components of Nd-Fe-B magnets – neodymium, iron and boron – are generally cheaper than samarium and cobalt. This is particularly true of cobalt, which is not abundant, and is found in countries that have had a history of political instability, particularly in the 1970's, prior to the development of Nd-Fe-B magnets. (CX-456, Q. 9).

351. Nd-Fe-B magnets have surpassed Sm-Co magnets as the industry standard because of their magnetic properties, ease of manufacture, and more reliable sources of supply

for the ingredients. (CX-456, Q. 13).

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353. A number of firms – including TDK, Shin-Etsu, Hitachi, UGIMAG, Crucible, Vacuumschmelze and others – are licensed to make Nd-Fe-B magnets under the Sumitomo Special Metals and Magnequench patents that cover Nd-Fe-B magnets and magnetic materials. (CX-456, Q. 15).

XIX. Inventorship (the '395 Patent)

354. After he received his Ph.D. in 1972, Croat began working in the Physics Department of the General Motors Corporation ("GM") Research Laboratories. (Croat, JX-1 at 9-10). As a staff research scientist, Croat worked on various permanent magnet materials, including samarium-cobalt magnets, manganese-aluminum-carbon magnets, and rare earth-iron based permanent magnets. (Croat, JX-1 at 12). While he worked at GM Research Laboratories, Dr. Croat published approximately 20 to 30 papers relating to magnets. (Croat, JX-1 at 13). In addition, Dr. Croat obtained 11 patents, nine of which related to neodymium-iron-boron magnets. (Croat, JX-1 at 40).

355. Jan Herbst received his Bachelor of Arts and Master of Science degrees in Physics

from the University of Pennsylvania in 1968. He received his Doctor of Philosophy degree in Physics from Cornell University in 1974. (CX-462, Q. 3). From January 1974 to September 1974, Herbst worked as a Research Associate at the Physics Department at Cornell University. (CX-462, Q. 4). From October 1974 to October 1976, he was a National Research Council Postdoctoral Research Associate at the National Bureau of Standards. (CX-462, Q. 4). From November 1976 to August 1977, Herbst was an Assistant Physicist at Brookhaven National Laboratory. (CX-462, Q. 4).

356. Because of a dramatic increase in the price of cobalt, Croat, John Keem and Herbst were asked to find alternatives to samarium-cobalt magnets. (CX-462, Q. 11 & Q. 14; Croat, JX-1 at 210). The goal of the research, which began around October 1978, was to produce permanent magnets and magnetic materials which had high coercivities. (Herbst, CX-462, Q. 12 & Q. 13). To accomplish this goal, the group decided to investigate light rare earth-iron alloys. (CX-462, Q. 15; Croat, JX-1 at 57; Keem, Tr. at 1622).

357. Keem suggested using melt spinning. (Croat, JX-1 at 209, l.20 - 210, l.1). Herbst testified that the concept of melt spinning is quite simple: a molten material is directed on to a spinning wheel. (Herbst, Tr. at 2006) At that time, the use of melt spinning was well known. (CX-462, Q. 18; Croat, JX-1 at 323-324). Guruswamy testified that the melt spinning process has been known for at least a century. (Guruswamy, Tr. at 692-693) The basic technique of melt spinning was taught in U.S. Patent No. 905,758 to Strange and Pim, which issued in 1908. (CX-462, Q. 19; CX-465) In fact, melt spinners were a standard piece of equipment in laboratories performing rapid solidification experimentation. (CX-462, Q. 18;

Croat, JX-1 at 323-332).

358. In addition, Croat, Herbst and Keem all agree that at that time of Keem's suggestion, the use of melt spinning to make amorphous alloys was well known. (CX-462, Q. 20; Croat, JX-1 at 218; Keem, Tr. at 1624-25). The use of melt spinning to produce amorphous metals was described in a paper from "Metallic Glasses," a seminar of the Material Science Division of the American Society for Metals, which was held on September 18 and 19, 1976. (CX-466) This paper was published in January 1978. (CX-462, Q. 21). Keem admitted that at the time he had the idea of using melt spinning, a company called Allied Signal was using melt spinning to make amorphous microstructures. (Keem, Tr. at 1625).

359. Keem built the melt spinner (the "GM melt spinner"). (Croat, JX-1 at 211; 324). While Keem had seen general descriptions of melt spinners in the literature, he had never performed melt spinning before coming to work at GM. (Keem, Tr. at 1625).

360. At the time Keem worked for GM, melt spinners typically had a crucible surrounded by a heating element with a nozzle or orifice at the bottom, and a spinning wheel below the nozzle. (Keem, Tr. at 1626). If one wanted to pressurize the crucible, a lid would be placed on the top of the crucible. (Keem, Tr. at 1626). In normal operation, the crucible would be filled with an alloy. (Keem, Tr. at 1626). The alloy would be melted and then expelled from the crucible on to a spinning wheel. (Keem, Tr. at 1626-1627). Keem admitted that the GM melt spinner had a crucible surrounded by a heating element with a lid at the top and a nozzle at the bottom, and a spinning wheel below the nozzle. (Keem, Tr. at 1627). The GM melt spinner would be filled with an alloy, which would be melted in the crucible.

(Keem, Tr. at 1628). The molten alloy would then be forced out of the nozzle and onto the spinning wheel. (Keem, Tr. at 1628).

361. The GM melt spinner was not substantially different from any other melt spinner. (CX-462, Q. 23). There was nothing in the GM melt spinner that was different or advanced in comparison to other melt spinners. (Croat, JX-1 at 331- 332). The design was standard; it was a crucible with a heating system and a rotating wheel that could be varied with an electric motor. (Croat, JX-1 at 323- 324). The molten material was directed out of a nozzle at the bottom of the crucible and onto the rotating wheel. (Croat, JX-1 at 145, 146,181- 182). Keem admitted that the GM melt spinner was not substantially different from any other melt spinner. (Keem, Tr. at 1626-1628).

362. After building the melt spinner, Croat and Keem tested it by making some iron-boron materials, which did not contain rare earth elements. (Croat, JX-1 at 320, 325). Herbst testified that Keem tested the melt-spinner by solidifying molten iron-boron and indium samples, which, again, did not contain rare-earth elements. (CX-462, Q. 23; Herbst, Tr. at 2011). Keem did not melt spin any neodymium-iron or praseodymium-iron samples. (CX-462, Q. 23).

363. Shortly after testing the melt spinner, Keem left the project. (CX-462, Q. 23 & Q. 24; Herbst, Tr. at 2011). Croat testified that Keem lost interest in the melt spinner and did not use it anymore. (Croat, JX-1 at 321). Keem was then assigned to work on a completely different project, which involved magnetostrictive and then piezoelectric materials. (CX-462, Q. 24; Croat, JX-1 at 211).

364. At the time Keem left the project, it was still in its initial phase. (Herbst, CX-462, Q. 25). The melt spinner had undergone some preliminary testing, but no neodymium-iron or praseodymium-iron materials had been melt spun. (CX-462, Q. 25). Keem admitted that he stopped using the melt spinner around the fall of 1979, and did not follow the permanent magnet project through to its full development. (Keem, Tr. at 1629).

365. The melt spinner was not used for some months, until Croat started using it in his research on melt spinning neodymium-iron and praseodymium-iron alloys. (Croat, JX-1 at 321; CX-462, Q. 26). Keem admitted that Croat continued the experimentation with the melt spinner. (Keem, Tr. at 1629).

366. Croat melt spun the praseodymium-iron and neodymium-iron alloys on his own. (CX-462, Q. 26; Croat, JX-1 at 322-323, 335). Keem was not involved in this work. (CX-462, Q. 26; Herbst, Tr. at 2000; Croat, JX-1 at 321- 322). Keem admitted that after he stopped working on the project, his involvement with Croat's experimentation was minimal. (Keem, Tr. at 1629).

367. At the time Croat was doing his experiments with neodymium-iron and praseodymium-iron alloys, and before, it was always thought that the best way to make high coercivity magnets was to cool them as quickly as possible. (Croat, JX-1 at 335; CX-462, Q. 27). So the usual approach was to melt spin the alloys as fast as possible and then heat treat to crystallize them. (Croat, JX-1 at 335; CX-462, Q. 27). However, based on some of his experimental work, Croat decided to slow down the wheel speed. (Croat, JX-1 at 335- 336). By slowing down the wheel speed, Croat slowed the quench rate and, to his surprise, got much

higher coercivities - as high as 8 kOe. (Croat, JX-1 at p.336). This discovery lead to the methods of making the high coercivity neodymium-iron and praseodymium-iron compositions claimed in the '395 patent. ('395 patent at col.5, ll.27-35).

368. Croat found that he could obtain hard permanent magnets with high coercivities, without the need for heat treatment, by slowing the cooling rate. (CX-462, Q. 27). The cooling rate had to be not so fast as to form amorphous, glass-like solids with soft magnetic properties, but fast enough to avoid the formation of a crystalline, soft magnetic microstructure. (CX-462, Q. 27). This optimum cooling rate lead to the high coercivity neodymium-iron and praseodymium-iron magnets claimed in the Asserted Claims of the '395 patent. (CX-462, Q. 27). Indeed, the specification of the '395 patent distinguishes Croat's high coercivity magnets from "any like composition previously formed by melt-spinning . . . ." ('395 patent at col.5, ll.35-39).

369. Croat discovered the desired quench rate during the course of his extensive experimentation, which was subsequent to Keem's involvement in Croat's research. (Croat, JX-1 at 321- 322, 322-323, 335). Keem did not participate in Croat's experimental work. (Croat, JX-1 at 321- 322, 333; CX-462, Q. 32). Keem had left the project several months before. (CX-462, Q. 32).

XX. Remedy

370. NEOCO has imported Nd-Fe-B magnets and/or magnetic materials produced by the following Chinese manufacturers: Liyang Jinma RE Materials Plant, Ci Xi Rare Earth Material Plant, Jinshan Fitting Plant, Yinbei and Heng Ci. (CX-228 at 7-12, 15-16).

371. A.U.G. has imported magnets produced by a Chinese manufacturer called { }(CX-114 at 88, 97-98). A.U.G.'s invoices also indicate that it purchased Nd-Fe-B magnets manufactured and/or exported by{ } (CX-123).

372. H.T.I.E. has imported Nd-Fe-B magnets produced by three Chinese manufacturers: { } (CX-148 at 57-59, 64-65, 72)). H.T.I.E.'s invoices also indicate that it purchased Nd-Fe-B magnets manufactured and/or exported by{ } (CX-152 H.T.I.E. invoices from 1993 and 1994).

373. Numerous companies offer to sell Nd-Fe-B magnets produced abroad in the United States on the Internet. (CX-384 (Princeton Electro-Technology, Inc., Magnetweb: Permanent Magnet Directory (visited May 10, 1999) <http://www. magnetweb.com/magnets2.htm>); CX-387-1 (Stanford Magnets Company, (visited May 10, 1999) <http://www.stanfordmagnets.com/>); CX-387-2 (Jobmaster Magnets, (visited May 10, 1999) <http://www.jobmaster.com/index.htm>); CX 387-3 (The Magnet Source, (visited May 10, 1999) <http.//www.magnetsource.com>); CX-387-5 (Puritan Magnetics, Inc., (visited May 10, 1999) <http://www.puritanmagnetics.com>); CX-388-1 (Hua Xing Magnetic Material Co., Ltd, (visited May 10, 1999), <http://www.is6.pacific.net.hk/~chengcy/ourfact1.html>); CX-388-2 (Main Rich

International Limited, (visited May 10, 1999), <http://www.mainrich.com/Introduction.htm>); CX-388-3 (Beijing International Aeronautical Materials Home Page, (visited May 10, 1999), <http://www.biam.com/res.htm>); [CX-387-6 (About General Magnetic Magnets, (visited May 29, 1999), <http://www.genmag.com/about.htm>);] CX-388-4 China Magnets -- Nd-Fe-B (Neodymium) Magnets (visited May 10, 1999), <http://www.chinamagnet.com/products/ndfeb.htm>); CX-385 (Fifteenth International Workshop on Rare Earth Magnets and Their Applications & Tenth International Symposium on Magnetic Anisotropy and Coercivity in Rare-Earth Transition Metal Alloys, (visited May 10, 1999), <http://www.ifw-dresden.de/remxv/program.htm>); CX-388-5 (Website for Yuxiang, (visited May 10, 1999), <http://www.yuxiang.xm.fj.cn/REPM3.HTM>); CX-387-7 (Adams Magnetic Products Home Page, (visited May 10, 1999), <http://www.adams.thomasregister.com/olc/adams/>); CX-388-6 (Huirong's Nd-Fe-B Permanent Magnets Homepage, (visited May 10, 1999), <http://www.huirong.com/magnets.htm>); CX-383 (Thomas Register, (visited May 10, 1999), <http://www.dialogclassic.com/DialogClassic/dialog>).

374. The Thomas Register is a trade publication commonly used by those in the magnet industry. The Thomas Register contains listings from a substantial number of U.S. companies dealing in Nd-Fe-B magnets and magnetic materials. (CX-133 at 163-64, 189-90); CX-238 at 118). CX-383 (Result from searching *Dialog* database for "neodymium" in the Thomas Register (search performed May 10, 1999),

<http://www.dialogclassic.com/DialogClassic/dialog>}).

375. Magnets imported into the United States from China are commonly shipped under documents issued by Chinese trading companies, not by the magnet manufacturer itself. (CX-291-C (NEOCO L.C.'s Answer to the First Set of Interrogatories Propounded by Complainants at 5); CX-148 (Tao I Dep. Tr. at 83-85).) These importation documents often do not specify the manufacturer or factory from where the magnets or magnetic materials originated, but instead denote the foreign trading company. (CX-309 (Selected invoices to A.U.G. from Chinese exporters/shipping co.'s, AUG 00378, 00387, 00390, 00491, 00519); CX-335 (Selected H.T.I.E. 1993-1994 invoices & freight bills from Chinese Trading Cos., 800148, 800150, 800156)).

376. The trading company that Respondent NEOCO uses to import Nd-Fe-B magnets into the United States from China is Shanghai Jiu Mao Foreign Trade Corp. (CX-228 at 7-10). NEOCO identifies this trading company as the "source" of the Nd-Fe-B magnets it imports into the United States. (CX-291 at 5).

377. Respondent A.U.G. has used several different trading companies to import Nd-Fe-B magnets from China into the United States. Some of the trading companies A.U.G. uses include{

} (CX-309 (Selected invoices to A.U.G. from Chinese exporters/shipping co.'s, AUG 00378, 00387, 00390, 00491, 00519)).

378. Respondent H.T.I.E. has used different trading companies to import Nd-Fe-B

magnets from China into the United States, including {

} (CX-152 (H.T.I.E. Invoices from 1993 and 1994); CX-335 (Selected H.T.I.E. 1993-1994 invoices & freight bills from Chinese Trading Cos., 800148, 800150, 800156)).

379. Respondent CYNNY has imported Nd-Fe-B magnets into the United States that were exported from China by a company called { } (CX-133 at 149-150).

380. Dr. Yifei Tao, a principal of NEOCO (and H.T.I.E. and A.R.E.) testified that Chinese manufacturers can export Nd-Fe-B magnets and magnetic materials through the export company of their choice. (CX-148 at 83-85)). Dr. Tao also testified that the export situation in China is "very complicated" and "not as clear-cut as the business in the U.S." (CX-148 at 83-84).

381. Imported Nd-Fe-B magnets have no markings on them that could be used to identify the producer of the magnet. (CX-75, Q. 85; CX-114 at 22-23, 85-89, 97-98, 101), CX-159; CX-238 at 109, 187); CX-148 at 182-83).

382. NEOCO's licensing agreement with the Navy requires that NEOCO specifically label its magnets so that NEOCO is identified as the manufacturer, and so that the Navy can easily track the magnet shipments in order to verify what magnets NEOCO has shipped and where NEOCO has shipped them. (Tr. at 1171-1172).

383. There is an established demand for sintered and bonded Nd-Fe-B magnets in the

United States. (CX-75, Qs. 36-37; CX-159 at 137-38; CX-148 at 172-73; CX-238 at 36-37, 68-69, 135-36; CX-435).

384. Since Nd-Fe-B magnets were introduced, they have been recognized in the industry to be a significant advance over earlier technology. The trend in recent years has been for an increase in demand for Nd-Fe-B magnets worldwide. Published data show that production and consumption of Nd-Fe-B magnets and magnetic materials in the United States is increasing. (Tr. at 980-81; CX-75, Q. 38).

385. Various industries that use Nd-Fe-B magnets, including the automotive, industrial motor, and computer industries, report a steady demand for Nd-Fe-B magnets. (CX-75, Q. 38).

386. One of the principal applications for Nd-Fe-B magnets in the United States today is voice coil motors in computers. Other common applications include small motors for automotive and other industrial applications, and magnetic resonance imaging. (Tr. at 1010-11; CX-75, Q. 39); See CX-413 (China Magnets 98, Jean-Michel Tourre, Rare Earth 98 - Recent Evaluation of the Market at pg 11,13); CX-394 (Simon Arron, Motoring: Looks, Speed, Range: It's a Quiet Revolution, THE DAILY TELEGRAPH (LONDON), Dec. 5, 1998, available in LEXIS, News file); CX-434 (Materials from Nd-Fe-B '99, Alan Crapo, Current and Future Motor Applications of Nd-Fe-B Magnets at 9). To the extent that the demand for computers remains steady or increases, the demand for Nd-Fe-B magnets and magnetic materials will remain steady or increase as well. (CX-75, Q. 41).

387. Nd-Fe-B magnets are also used in a number of popular electronics products,

including headphones, televisions, VCRs, cameras, and speaker systems. (See CX-238 (Coleman Dep. Tr. at 68-69); CX-394 (Simon Arron, Motoring: Looks, Speed, Range: It's a Quiet Revolution, THE DAILY TELEGRAPH (LONDON), Dec. 5, 1998, available in LEXIS, News file); CX-396 (AMR Announces 1998 Third Quarter Results, CANADA NEWSWIRE LTD., Nov. 12, 1998, available in LEXIS, News file); CX-400 (AMR Technologies, Inc., CANADA NEWSWIRE LTD., Sept. 3, 1998, available in LEXIS, News file); CX-399 (Logitech Enters PC Sound Market with Sound Man Family of Compact, Powerful Multimedia Speakers, MULTMEDIA NEWS, Sept. 18, 1998, available in LEXIS, News file); CX-386 (<http://www.giantsavings.com/dndbenterprisesinc/ sonmdrw20gsp.html>)).

388. A representative of a U.S. motor manufacturer recently announced at an Nd-Fe-B magnet industry conference that he expects his company's annual consumption of Nd-Fe-B magnets and magnetic materials to increase from approximately 56,000 lbs. to nearly 100,000 lbs over the next three years. (CX-435 at 5).

389. The demand for Nd-Fe-B magnets in the United States is likely to increase in the future. (CX-75, Q. 40).

390. Nine of the Respondents in this Investigation -- A.U.G., CYNNY, H.T.I.E., Harvard, A.R.E., Multi-Trend, I.M.I., Houghes, and NEOCO -- are engaged in the importation and/or distribution of Nd-Fe-B magnets and magnetic materials. (See Order No. 38).

391. NEOCO has imported into the United States rapidly-quenched Nd-Fe-B powder for producing bonded Nd-Fe-B magnets. The powder was produced by a Chinese company

called Zibo. (CX-228 at 21-22, 39-40, 69-70).

392. CYNNY has imported and/or sold following importation Nd-Fe-B magnets manufactured by { } (CX-133 at 88-89, 149-150, 205).

393. Harvard has imported Nd-Fe-B magnets manufactured by Respondent High End Metals Corp. (CX-187 Tr. at 52).

394. CYNNY, A.R.E. and I.M.I. have engaged in distribution and sale of magnets imported by others (including A.U.G.,{ } and Houghes, and other firms not named as respondents). (CX-133 at 42-43); CX-228 at 6-7); CX-238 at 50).

395. A.R.E. purchases magnets from NEOCO. (CX-148 at 113-14; CX-228 at 9, 171-72). A.R.E. also has purchased magnets directly from Chinese trading company Shanghai Jiu Mao. (CX-228 at 63-64).

396. CYNNY has engaged in distribution and sale of Nd-Fe-B magnets imported by { } another importer not named as a Respondent in this Investigation. (CX-133 at 42-43).

397. A large number of firms import Nd-Fe-B magnets and magnetic materials, mostly from China. Due to the small size and high mobility of many firms, it is difficult to estimate exactly how many importers and distributors of magnets and magnetic materials currently operate in the United States. (CX-75, Q. 80).

398. Principals from A.U.G., CYNNY and H.T.I.E. have testified that they have imported magnets from foreign sources in addition to the foreign manufacturers named as

Respondents in this Investigation. (CX-114 at 31-33, 88-89, 97-98; CX-148 at 57-59, 64-65, 72); CX-333, Ex. 1; CX-238 at 110-17, 119-22, 126-29).

399. It is relatively easy to develop contacts in the Nd-Fe-B industry, for example, by attending the industry conferences on a regular basis. (CX-75, Q. 76, CX-413 (China Magnets '98 (Oct. 18-21, 1998) (conference materials)); CX-238 at 110-12)).

400. There is also a great deal of material available on the Internet regarding the Nd-Fe-B magnets and magnetic materials business, including information on sources of product, industry organizations, etc. (CX-75, Q 76-77; CX-384 (Princeton Electro-Technology, Inc. Magnetweb: Permanent Magnet Directory (visited May 10, 1999)) <http://www.magnetweb.com/magnets2.htm>); CX-387-2 (Jobmaster Magnets, (visited May 10, 1999) <http://www.jobmaster.com/index.htm>); CX-387-3 (The Magnet Source, (visited May 10, 1999) <http://www.magnetsource.com>); CX-387-5 (Puritan Magnetics, Inc. (visited May 10, 1999) <http://www.puritanmagnetics.com>); CX-388-1 (Hua Xing Magnetic Material Co., Ltd,. (visited May 10, 1999), <http://www.is6.pacific.net.hk/~chengcy/ourfact1.html>); CX-388-2 (Main Rich International Limited, (visited May 10, 1999), <http://www.mainrich.com/Introduction.htm>; CX-388-3 (Beijing International Aeronautical Materials Home Page, (visited May 10, 1999), <http://www.biam.com/res.htm>); CX-387-6 (About General Magnetic Magnets, (visited May 29, 1999, <http://www.genmag.com/about.htm>); CX-388-4 China Magnets -- Nd-Fe-B (Neodymium) Magnets (visited May 10, 1999),

<http:www.chinamagnet.com/products/ndfeb.htm>); CX-385 (Fifteenth International Workshop on Rare Earth Magnets and Their Applications & Tenth International Symposium on Magnetic Anisotropy and Coercivity in Rare-Earth Transition Metal Alloys, (visited May 10, 1999), <http://www.ifw-dresden.de/remxv/program.htm>); CX-388-5 (Website for Yuxiang, (visited May 10, 1999), <http://www.yuxiang.xm.fj.cn/REPM3.HTM>); CX-387-7 (Adams Magnetic Products Home Page, (visited May 10, 1999), <http://www.adams.thomasregister.com/0lc/adams/>); CX-388-6 (Huirong's Nd-Fe-B Permanent Magnets Homepage, (visited May 10, 1999), <http://www.huirong.com/magnets.htm>); CX-383 (Thomas Register, (visited May 10, 1999), <http://www.dialogclassic.com/DialogClassic/dialog>)).

401. Aside from the Thomas Register, other trade magazines carry advertisement for Nd-Fe-B magnets and magnetic materials. (CX-187 at 108-09).

402. The Thomas Register and the trade magazines serve as a source of information for foreign Nd-Fe-B magnet manufacturers who seek to identify U.S. importers, distributors to find customers. (CX-187 at 107-09).

403. Representatives of Chinese magnet manufacturers regularly attend conferences regarding the magnet industry. (Tr. at 967). In fact, representatives of at least 8 to 10 Chinese magnet factories attended the April 1999 Nd-Fe-B magnet conference in San Francisco. (CX-75, Q. 46).

404. There are currently over 100 separate companies or factories in China that produce sintered Nd-Fe-B magnets. (Tr. at 968; CX-75, Qs. 44, 45, CX-114 at 130-131,

140-47; CX-159 at 47, 152-53; CX-238 at 13; CX-187 at 104; CX-133 at 160, 163; CX-148 at 166; CX-228 at 156; CX-409 (Luo Yang, Further Development of Nd-Fe-B Magnet Industry in China at 5)).

405. China's annual production of Nd-Fe-B magnets and magnetic materials has increased from 180 tons to 3,850 tons during the period 1990-98, and is projected to reach 7,000 tons by the year 2000. In addition, about 20 factories in China each have the capacity to produce over 150 tons of Nd-Fe-B magnets per year, which is a very substantial amount. (CX-75, Qs. 48-50; CX-409 (Yang Luo paper at 3, 5).

406. U.S. firms that trade in Nd-Fe-B magnets and magnetic materials receive facsimiles regularly from Chinese Nd-Fe-B magnet manufacturers who want to sell their magnets in the United States. (CX-238 at 126-129).

407. Imported Nd-Fe-B magnet shipments are often accompanied by documents that identify the magnets as parts of other products or by the material of which the magnets are made. The labels that are frequently used include "AC motor parts," "electric components," "electrical generator parts," "speaker parts," and "rare earth metals." (CX-75, Q. 86; Tr. at 1034-36; CX-159 at 88-89 (imports labeled as "parts for speaker"); CX-114 at 84-89, 97-98, 101, 194-96; CX-123 (Misc. A.U.G. invoices at 00378-00421, 00423, 00425,00428-00435, 00438-00442, 00445-00457, 00459-00466, 00468-00475, 00477-00479, 00481-00485, 00487-00489, 00491-00494, 00496-00497, 00499-00500, 00502, 00504, 00506-00510, 00513-00517, 00520-00525, 00527-00528, 00530-00531, 00533, 00536-00538, 00547, 00549-00550, 00552, 00554-00559, 00563-00566, 00574, 00576, 00579, 00584-00586, 00588,

00591-00594, 00598-00601, 00603-00605, 00607-00608, 00611-00614, 00616, 00620, 00624, 00627-00630, 00635-00636, 00638, 00641-00646, 00650-00653, 00655, 00657-00658, 00663-00666, 00668-00669, 00673, 00675) (invoices labeled as "AC Motor Parts," "Electric Components," "Electrical Generator Parts," "Accessories of Power Saving Unit"); CX-416, Ex. 2 at 900028; CX-423, Ex. 8 at 700127, 700131-700135, 700147, 700151, 700191) (invoices and shipping documents describing magnets as "electronic parts," "rare earth metals," CX-424, Ex. 14 at 700360, 700362, 700364, 700366, 700368) (invoices stating "rare earth metals"); CX-228 at 31-32) (magnets identified generically as "electrical generator parts" on invoice).

408. Former respondent Houghes has imported Nd-Fe-B magnets into the United States described as "parts for speaker." (CX-159 at 88-89; CX-416, Ex. 2 at 900028).

409. Former respondent A.U.G. has imported Nd-Fe-B magnets into the United States described as "AC Motor Parts," "Electrical Components," "Electrical Generator Parts," and "Accessories of Power Saving Unit." (CX-123 (Misc. A.U.G. invoices at 00378-00421, 00423, 00425,00428-00435, 00438-00442, 00445-00457, 00459-00466, 00468-00475, 00477-00479, 00481-00485, 00487-00489, 00491-00494, 00496-00497, 00499-00500, 00502, 00504, 00506-00510, 00513-00517, 00520-00525, 00527-00528, 00530-00531, 00533, 00536-00538, 00547, 00549-00550, 00552, 00554-00559, 00563-00566, 00574, 00576, 00579, 00584-00586, 00588, 00591-00594, 00598-00601, 00603-00605, 00607-00608, 00611-00614, 00616, 00620, 00624, 00627-00630, 00635-00636, 00638, 00641-00646, 00650-00653, 00655, 00657-00658, 00663-00666, 00668-00669, 00673, 00675 (invoices

labeled as "AC Motor Parts," Electric Components, "Electrical Generator Parts," "Accessories of Power Saving Unit")).

410. Respondent Harvard has imported Nd-Fe-B magnets into the United States described as "rare earth metals." (CX-123, Ex. 8 at 700127, 700131-700135, 700147, 700151, 700183, 700191; CX-424, Ex. 14 at 700360, 700362, 700364, 700366, 700368).

411. Former respondent H.T.I.E. has imported Nd-Fe-B magnets into the United States described as "electrical generator parts." (CX-228 at 31-32).

412. Dr. Tao, a principal of former respondent H.T.I.E., testified that trading companies will often label shipments of magnets as "parts for loud speakers" or labels other than "magnets." (CX-148 at 80-81).

413. Principals of former respondents A.U.G., Houghes, and H.T.I.E. have confirmed that the documents accompanying their import shipments of Nd-Fe-B magnets listed products other than magnets, and that one could not tell from the documents themselves that the shipments contain Nd-Fe-B magnets. (CX-114 at 85-89, 97-98, 101; CX-159 at 88-89; CX-148 at 78-81, 83-85).

CONCLUSIONS OF LAW

1. The Commission has in rem jurisdiction and subject matter jurisdiction.

2. There has been an importation of certain rare earth magnets and magnetic materials and articles containing the same in issue which are the subject of the unfair trade allegations.

3. Complainants' activities satisfy the domestic industry requirements (both the economic and technical prongs) of section 337.

4. The claims of the patents in issue are valid and enforceable.

5. Accused magnets of respondent NEOCO infringe

Patent '058 Claims 1, 4, 5, 8, 9 and 11
Patent '931 Claims 1, 2, 3, 4, 5, 6, 10, 14, 15, 16, 18, 19 and 20
Patent '395 Claims 13, 14, 15, 16, 17 and 18
Patent '723 Claims 2, 3, 4, 5, 6, 7, 9, 24, 31
Patent '368 Claims 2, 3, 4, 5, 6, 8, 10, 29 and 37
Patent '651 Claims 1, 2, 3, 15, 18, 19, 21 and 22

6. Accused magnets of respondent Harvard infringe

Patent '058 Claims 1, 4, 5, 8, 9 and 11
Patent '931 Claims 1, 2, 3, 4, 5, 6, 10, 14, 15, 16, 18, 19 and 20
Patent '395 Claims 13, 14, 15, 16, 17 and 18
Patent '368 Claims 2, 3, 4, 5, 6, 8, 10, 29, 37 and 38
Patent '651 Claims 1, 2, 3, 15, 18, 19, 21 and 22

7. Accused magnets of High End infringe

Patent '058 Claims 1, 4, 5, 8, 9 and 11
Patent '931 Claims 1, 2, 3, 4, 5, 6, 10, 14, 15, 16, 18, 19 and 20
Patent '395 Claims 13, 14, 15, 16, 17 and 18
Patent '723 Claims 2, 3, 4, 5, 6, 7, 9, 24, 31
Patent '368 Claims 2, 3, 4, 5, 6, 8, 10, 29, 37 and 38
Patent '651 Claims 1, 2, 3, 15, 18, 19, 21 and 22

8. Accused magnets of A.R.E. infringe

Patent '058 Claims 1, 4, 5, 8, 9 and 11

Patent '931 Claims 1, 2, 3, 4, 5, 6, 10, 14, 15, 16, 18, 19 and 20
Patent '395 Claims 13, 14, 15, 16, 17 and 18
Patent '723 Claims 2, 3, 4, 5, 6, 7, 9, 24, 31
Patent '368 Claims 2, 3, 4, 5, 6, 8, 10, 29 and 37
Patent '651 Claims 1, 2, 3, 15, 18, 19, 21 and 22

9. Accused magnets of Jing Ma infringe

Patent '058 Claims 1, 4, 5, 8, 9 and 11
Patent '931 Claims 1, 2, 3, 4, 5, 6, 10, 14, 15, 16, 18, 19 and 20
Patent '395 Claims 13, 14, 15, 16, 17 and 18
Patent '723 Claims 2, 3, 4, 5, 6, 7, 8, 9, 24, 31 and 34
Patent '651 Claims 1, 5, 15, 18, 19, 21 and 22

10. Accused magnets of Xin Huan infringe

Patent '058 Claims 1, 4, 5, 8, 9 and 11
Patent '931 Claims 1, 2, 3, 4, 5, 6, 10, 14, 15, 16, 18, 19 and 20
Patent '395 Claims 13, 14, 15, 16, 17 and 18
Patent '723 Claims 2, 3, 4, 5, 6, 7, 8, 9, 24 and 31
Patent '368 Claims 2, 3, 4, 5, 6, 8, 9, 10, 29, 37 and 38
Patent '651 Claims 1, 2, 3, 15, 18, 19, 21 and 22

11. Accused magnets of Multi-Trend infringe

Patent '058 Claims 1, 4, 5, 8, 9 and 11
Patent '931 Claims 1, 2, 3, 4, 5, 6, 10, 14, 15, 16, 18, 19 and 20
Patent '395 Claims 13, 14, 15, 16, 17 and 18
Patent '723 Claims 2, 3, 4, 5, 6, 7, 9, 24, 31 and 34
Patent '651 Claims 1, 5, 15, 18, 19, 21 and 22

12. Complainants have not sustained their burden in establishing infringement by any respondents of Patent '723 Claims 13, 14, 15, 16, 17, 18, 19, 20, 25, 26, 27 and 33.

13. Complainants have not sustained their burden in establishing infringement by any respondents of Patent '368 Claims 15, 16, 17, 18, 19, 21, 23, 24, 28, 30, 31 and 35.

14. Respondent NEOCO has not sustained its burden in establishing that complainants have engaged in antitrust violations or patent misuse.

15. Respondent NEOCO has not sustained its burden in establishing that complainants engaged in inequitable conduct before the United States Patent and Trademark Office.

16. Respondent NEOCO has not sustained its burden in establishing that complainants engaged in unfair acts or unlawful methods of competition.

17. Respondents NEOCO, Harvard, High End, A.R.E., Jing Ma, Xin Huan and Multi-Trend are in violation of section 337, based on their importation into the United States, sale for importation, and/or sale within the United States after importation of articles that infringe valid and enforceable United States patents.

18. Based on record, it is recommended that a general exclusion order be entered.

19. Based on the record its is recommended that cease and desist orders issue against repondents Harvard, A.R.E. and Multi-Trend.

20. A bond of 100% of entered value during Presidential review is recommended.

ORDER

Based on the foregoing opinion, additional findings of fact, conclusions of law, and the record as a whole, and having considered all of the pleadings, evidence and arguments presented orally and in briefs, as well as certain proposed findings of fact, it is the administrative law judge's final initial determination that there is a violation of section 337 in the importation into the United States, sale for importation, and the sale within the United States after importation of certain rare earth magnets and magnetic materials and articles containing the same. It is also the administrative law judge's recommendation that a general exclusion order, as well as cease and desist orders against respondents Harvard, A.R.E. and Multi-Trend, should issue and that a bond of 100% of entered value during Presidential review should be imposed.

The administrative law judge hereby CERTIFIES to the Commission his final initial and recommended determinations together with the record consisting of the exhibits admitted into evidence. The pleadings of the parties filed with the Secretary and the transcript of the hearing, including closing arguments, are not certified, since they are already in the Commission's possession in accordance with Commission rules of Practice and Procedure.

Further it is ORDERED that:

1. In accordance with Commission rule 210.39, all material heretofore marked in camera because of business, financial, and marketing data found by the administrative law judge to be cognizable as confidential business information under Commission rule 201.6(a) is to be given in camera treatment continuing after the date this investigation is terminated.

2. Counsel for the parties shall have in the hands of the administrative law judge

those portions of the final initial and recommended determinations which contain bracketed confidential business information to be deleted from any public version of said determinations, and all attachments thereto, no later than September 29, 1999. Any such bracketed version shall not be served by telecopy on the administrative law judge. If no version is received from a party it will mean that the party has no objection to removing the confidential status, in its entirety, from the initial and recommended determinations.

3. The final initial determination portion of the "Initial and Recommended Determination," issued pursuant to Commission rule 210.42(h)(2), shall become the determination of the Commission forty-five (45) days after the service thereof, unless the Commission, within forty-five (45) days after the date of such service of the initial determination portion shall have ordered review of that portion or certain issues therein or by order has changed the effective date of the initial determination portion. Any findings and recommendation, made by the administrative law judge in said recommended determination portion, issued pursuant to Commission rule 210.42(a)(1)(ii), will be considered by the Commission in reaching a determination on remedy and bonding pursuant to Commission rule 210.50(a).

Paul J. Luckern
Administrative Law Judge

Issued: September 8, 1999

CERTAIN RARE-EARTH MAGNETS AND MAGNETIC MATERIALS AND ARTICLES CONTAINING THE SAME **Inv. No. 337-TA-413**

CERTIFICATE OF SERVICE

I, Donna R. Koehnke, hereby certify that the attached **Final Initial and Recommended Determinations (Public Version)** was served by hand upon Thomas S. Fusco, Esq., and Benjamin D. M. Wood, Esq. and upon the following parties via first class mail, and air mail where necessary, on October 20, 1999.

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<u>CERTIFICATE OF SERVICE</u> pg. 2

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