In the Matter of

CERTAIN AMORPHOUS METAL ALLOYS AND AMORPHOUS METAL ARTICLES

Investigation No. 337-TA-143

ADVISORY OPINION PROCEEDINGS

USITC PUBLICATION 2035

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United States International Trade Commission / Washington, DC 20436

UNITED STATES INTERNATIONAL TRADE COMMISSION

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Washington, D.C. 20436

In the Matter of	
CERTAIN AMORPHOUS METALS AND AMORPHOUS METAL ARTICLES	Investigation No. 337-TA-143

NOTICE OF ISSUANCE OF ADVISORY OPINION

AGENCY: U.S. International Trade Commission.

ACTION: Issuance of advisory opinion.

SUMMARY: The Commission has issued an advisory opinion finding that certain processes for manufacturing amorphous metals would not, if practiced in the United States, infringe U.S. Letters Patent 4,221,257 (the '257 patent). Amorphous metals manufactured by these non-infringing processes are not covered by the exclusion order issued by the Commission in October 1984 in the above-captioned investigation.

FOR FURTHER INFORMATION CONTACT: Jean H. Jackson, Esq., Office of the General Counsel, telephone 202-523-1693. Hearing impaired individuals may obtain information on this matter by contacting the Commission's TDD terminal at 202-724-0002.

SUPPLEMENTARY INFORMATION: At the conclusion of the above-captioned investigation, the Commission issued an order excluding from entry into the United States products made by amorphous metal casting processes that, if practiced in the United States, would infringe claims 1, 2, 3, 5, 8, or 12 of U.S. Letters Patent 4,221,257. At the request of respondents Hitachi Metals Ltd., Hitachi Metals International Ltd, and Vacuumschmelze GmbH, the Commission instituted advisory opinion proceedings to determine whether articles made by these respondents' modified processes are subject to the exclusion order issued in this investigation. The Commission has completed the advisory opinion proceedings and determined that respondents' modified processes would not infringe the '257 patent if practiced in the United States. Amorphous metals manufactured by those non-infringing processes are therefore not covered by the exclusion order issued in the subject investigation.

The Commission's action was taken pursuant to 19 C.F.R. §211.54(b).

Copies of the advisory opinion and all other nonconfidential documents filed in connection with this investigation are available for inspection during official business hours (8:45 a.m. to 5:15 p.m.) in the Office of the Secretary, U.S. International Trade Commission, 701 E Street NW., Washington, D.C. 20436, telephone 202-523-0161.

By order of the Commission.

Kenneth R. Mason
Secretary

Issued: May 28, 1987

Public Version
[Confidential Business Information Deleted]

United States International Trade Commission
Washington, D.C. 20436

In the Matter of CERTAIN AMORPHOUS METAL ALLOYS AND AMORPHOUS METAL ARTICLES	Investigation No. 337-TA-143 ADVISORY OPINION PROCEEDINGS

VIEWS OF THE COMMISSION 1/

The Commission has determined to affirm, with certain modifications, the initial advisory opinion (IAO) 2/ of the administrative law judge (ALJ) with respect to the exclusion order the Commission issued in Certain Amorphous Metal Alloys and Amorphous Metal Articles, Inv. No. 337-TA-143. We therefore determined that the processes of respondents Hitachi Metals, Ltd., Hitachi Metals International, Ltd., and Vacuumschmelze GmbH for the manufacture of amorphous metal would not infringe U.S. Letters Patent 4,221,257 (the '257

1/ This opinion contains the following abbreviations: ALJ = Administrative Law Judge; AO-FF = Findings of Fact issued with the Initial Advisory Opinion, March 3, 1986; AO-TR = Transcript of Advisory Opinion Proceedings, Nov. 11-14, 1985; FR = Findings on Hearing on New Evidence and Information Requested on Remand, August 14, 1986; IA = Commission Investigative Attorney; IAO = Initial Advisory Opinion, March 3, 1986; ID = Unreviewed Initial Determination issued in this investigation, Oct. 24, 1984; ID-FF = Findings of Fact issued with the Initial Determination, Oct. 24, 1984; RD = Recommended Determination issued in the Modification of Exclusion Order Proceedings, March 3, 1986; R-TR = Transcript of Hearing on Remand, July 21-23, 1986.

2/ Issued on March 3, 1986.

patent) if practiced in the United States. [3/] The Findings of Fact issued with the IAO are adopted to the extent that they are not inconsistent with this opinion.

BACKGROUND

I. Procedural History

An investigation was conducted in 1983 and 1984 to determine whether there was a violation of section 337 of the Tariff Act of 1930 (19 U.S.C. § 1337) in the importation or sale of certain amorphous metal alloys and amorphous metal articles from Japan and the Federal Republic of Germany. [4/] After finding a violation in the importation of the accused articles, the Commission issued a general exclusion order which prohibited the entry of amorphous metal articles cast abroad by the processes claimed in claims 1, 2, 3, 5, 8, or 12 of the '257 patent. The '257 patent is owned by complainant Allied Corporation (Allied). [5/]

The Commission's final determination in the original investigation (an unreviewed initial determination, hereinafter referred to as the ID) construed the claims of the '257 patent and found that while the respondents' casting

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3/ The '257 patent is the basis for the Commission's exclusion order.

4/ See 48 Fed. Reg. 15963 (Apr. 13, 1983); 48 Fed. Reg. 43108 (Sept. 21, 1983); 49 Fed. Reg. 4047 (Feb. 1, 1984).

5/ Commission Action and Order of October 15, 1984. See Certain Amorphous Metal Alloys and Amorphous Metal Articles, Investigation No. 337-TA-143, USITC Publication 1664 (Nov. 1984); 49 Fed. Reg. 42083 (Oct. 24, 1984).

processes were infringing, the modification of certain features would avoid infringement. [6/] Respondents Hitachi Metals, Ltd. and Hitachi Metals International, Ltd. (collectively, HML), and respondent Vacuumschmelze GmbH (Vac) thereafter claimed to have modified their casting processes to avoid infringement, and requested (1) modification of the Commission's exclusion order under Commission rule 211.57 (19 C.F.R. § 211.57) or (2) issuance of an advisory opinion under Commission rule 211.54 (19 C.F.R. § 211.54) to allow or facilitate the importation of articles cast by the modified processes. [7/]

The Commission granted respondents' request and instituted advisory opinion proceedings under rule 211.54 to determine whether respondents' modified casting processes would infringe the '257 patent if those processes were practiced in the United States. The Commission also authorized consolidation of the HML and Vac advisory proceedings [8/] and instituted exclusion order modification proceedings on its own motion to determine whether its exclusion order should be modified, vacated, or left unchanged. The Commission ordered that the modification proceedings be presided over by an ALJ who would conduct adversary proceedings, make findings of fact and conclusions of law, and issue a recommended determination (RD). [9/]

6/ See generally USITC Pub. 1664—Unreviewed Initial Determination of May 14, 1984 (ID) at 44, 62-70; 49 Fed. Reg. 29159 (July 18, 1984).

7/ See Motion No. 143-86"C" filed February 22, 1985 (HML) and Motion No. 143-89"C" filed May 23, 1985. (Vac).

8/ Commission Action and Order of July 26, 1985; Commission Action and Order of Sept. 11, 1985 ; 19 C.F.R. § 211.54(b).

9/ Commission Action and Order of July 26, 1985, 50 Fed. Reg. 31260 (Aug. 1, 1985); 19 C.F.R. § 211.57. Our determination in the modification proceedings will be issued in a separate opinion.

On March 3, 1986, the presiding administrative law judge issued an initial advisory opinion together with findings of fact and conclusions of law concerning the respondents' modified casting processes. The IAO determined that HML and Vac now have the capability of manufacturing good quality wide amorphous metal strip in commercial quantities by casting processes that have been modified to avoid infringement of the '257 patent. 10/ Allied and the Commission investigative attorney (IA) petitioned for review of the IAO on March 28, 1986.

On June 5, 1986, the Commission determined to review the IAO and to remand the advisory proceedings to the ALJ. 11/ On remand, the ALJ was asked to provide additional findings as well as supplement the IAO with additional citations to the record and legal authorities. The Commission also referred a motion to the ALJ filed by Allied for admission of new evidence and sanctions against HML. 12/ The Commission asked the ALJ to consider whether the new evidence should be admitted and, if admitted, whether it would change the findings in the IAO concerning HML or the recommendation given in the RD. On August 14, 1986, after completing an evidentiary hearing based on the new evidence, the ALJ issued additional findings. The ALJ did not, however, alter the determination of the IAO or the recommendation given in the RD.

10/ IAO at 39.

11/ Commission Action and Order of June 13, 1986.

12/ Id. See Motion 143-120 "C".

II. The Parties

Allied Corporation, complainant in the Amorphous Metals investigation, is organized under the laws of New York and has its principal place of business in Morristown, New Jersey. 13/ Respondent Hitachi Metals, Ltd. is a Japanese corporation located in Tokyo, Japan. Respondent Hitachi Metals International, Ltd., a subsidiary of Hitachi Metals, Ltd., is a domestic corporation located in White Plains, New York. 14/ Respondent Vacuumschmelze GmbH is a German corporation with its main offices in Hanau, Federal Republic of Germany. 15/ These respondents participated in the original investigation and were found to have been using processes to manufacture amorphous metal that, if practiced in the United States, would infringe the '257 patent.

III. History of the '257 patent 16/

On October 22, 1976, Allied filed a patent application with the U.S. Patent and Trademark Office (PTO) entitled "Continuous Casting Methods for Metallic Strips". This original application contained a set of claims to a strip of amorphous metal as well as sets of claims for both the method and apparatus used in producing the strip. Allied allowed the original application to become abandoned and filed a continuation-in-part (CIP) application on August 2, 1977. The CIP application added new material to the

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13/ ID-FF 6

14/ ID-FF 7-8.

15/ ID-FF 12.

16/ See generally ID-FF 289-300.

specification that was filed with the original application and repeated the same three sets of claims that were presented in the original application. The PTO required Allied to limit its application to only one set of claims. Allied elected to prosecute its apparatus claims, and eventually was granted a patent for an apparatus used in producing amorphous metal strips (U.S. Letters Patent 4,142,571, issued March 6, 1979). On October 10, 1978, Allied filed a divisional application (based on the CIP application) which contained only process claims. On September 9, 1980, the divisional application matured into U.S. Letters Patent 4,221,257, entitled "Continuous Casting Methods for Amorphous Metallic Strips", the patent at issue in these proceedings.

ISSUE PRESENTED

Articles made by processes that would infringe the '257 patent, if practiced in the United States, are barred from entry by an exclusion order which was issued in October 1984 at the end of Inv. No 337-TA-143. 17/ The issue presented in these advisory proceedings is whether the importation of articles made by respondents' modified processes would be covered by the exclusion order issued in the original investigation. 18/ This entails determining whether the modified processes would infringe the relevant claims of the '257 patent if the processes were practiced in the United States.

17/ Commission Action and Order of October 15, 1984.

18/ Rule 211.54(b); 19 CFR 211.54(b).

INFRINGEMENT

Analysis of patent infringement entails two inquiries: determination of the scope of the claims, a question of law; and the factual finding of whether properly construed claims encompass the accused structures. 19/ This analytical framework applies whether claims are asserted to be infringed literally or by application of the doctrine of equivalents. 20/

I. Determination of the Scope of the Claims

A. The Patent

The '257 patent discloses a "continuous casting method for metallic amorphous strips." The claims at issue are claims 1-3, 5, 8, and 12.

The broadest claim is claim 1, which reads as follows:

> 1. A method of forming continuous strip of amorphous metal from a molten alloy capable of forming an amorphous structure comprising:
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> a. forcing the molten alloy under pressure through a slotted nozzle positioned generally perpendicular to the direction of movement of a chill surface and located in close proximity to the chill surface to provide a gap of from about 0.03 to about 1 millimeter between said nozzle and the chill surface;
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> b. advancing the chill surface, at a predetermined speed; and
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> c. quenching the molten metal in contact with the chill surface at a rapid rate to effect

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19/ Texas Instruments Inc. v. U.S.I.T.C., 231 U.S.P.Q. at 834 (citing Mannesmann Demag Corp. v. Engineered Metal Products Co., 793 F.2d 1279, 1282, 230 U.S.P.Q. 45, 46 (Fed. Cir. 1986) and Caterpillar Tractor Co. v. Berco, S.P.A., 714 F 2d 1110, 1114, 219 U.S.P.Q. 185, 187 (Fed. Cir. 1983)).

20/ Texas Instruments, 231 U.S.P.Q. at 834.

> solidification into a continuous amorphous metal strip. 21/

Claims 2, 3, 5, and 8 each incorporate "the method of claim 1," and add various limitations on the process features recited in that claim. Claims 2, 3, 5, and 8 are dependent on independent claim 1. Claim 12 is an independent claim. Although claim 12 does not incorporate "the method of claim 1", it encompasses the elements of claim 1 and adds various limitations to the process features recited in that claim. Claim 1 is the broadest claim, and claim 12 is directed to the preferred embodiment of the '257 patent. Because claim 1 is the broadest claim, if it has not been infringed, neither have any of the other claims.

B. The Original Investigation

In the original investigation the Commission determined, among other things, that:

> 1. [T]he word "nozzle" as used in the '257 patent claims is ambiguous as to the structure of the nozzle, and . . . the specification can be used to construe this word. The '257 claims are construed as including the critical feature of the wide lips on the nozzle. Allied, however, must prove that each respondent has used this feature before infringement can be found.
>
> The '257 patent is not invalid under [35 U.S.C. § 112]. The claims read in the light of the specification particularly point out and distinctly claim the subject matter which the applicant regards as his invention. 22/

21/ For purposes of the '257 patent, a strip is a slender body with transverse dimensions that are much less than its length. This includes wire, ribbon, and sheets of regular or irregular cross-section. '257 Patent at Col. 1, lines 17-20.

22/ ID at 44.

> 2. It is important at the outset to distinguish between a comparison of Narasimhan's [the inventor of the '257 patent] invention as he saw it (including the width of the lips of the nozzle supporting the molten metal) with the prior art, and a comparison of the claims of the '257 patent with the prior art. If the Narasimhan invention is compared with the prior art, the subject matter of the invention as a whole would not have been obvious to one with ordinary skill in the art at the time of the invention. If the '257 claims (read literally) are compared with the prior art, however, 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 of casting amorphous metal. The critical features of the Narasimhan invention relating to supporting the melt on the width of the lips of the nozzle can be read into the claims from the specification because the references to "nozzle" in the claims are ambiguous. The decisive comparison therefore is between the invention as set forth in the specification and the prior art. 23/
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> 3. If the claims of the '257 patent are valid, it is only because the critical limitation relating to the width of the lips was read into the claims. If a respondent used a nozzle without wide lips, infringement could not be found. 24/

The Commission thus determined that if the claims of the '257 patent were read literally, they would be invalid under 35 U.S.C. § 103 for obviousness. The Commission, however, construed the claims of the '257 patent to include the critical feature of wide nozzle lips on the casting nozzle, and determined that the claims so construed would not be invalid under 35 U.S.C. § 103. The Commission also found that the claims of the '257 patent were valid under

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23/ Id. at 48.

24/ Id. at 64. (See generally, ID at 62-73 concerning infringement of the '257 patent, and ID-FF 446-553.)

35 U.S.C. § 112, but only if read in light of the specification. 25/ Finally, the Commission stated that if respondents used slotted nozzles without wide flat lips, they would not infringe the claims of the '257 patent as so construed. 26/

As discussed below, neither the characterization of the '257 invention as set forth in the ID nor the ID's determination concerning the validity of the '257 patent were subject to redetermination in these proceedings.

C. The Review

In its petition for review of the IAO, Allied argued that the Commission should not follow the characterization of the '257 invention set forth in the ID, but instead should characterize the "essence" of the invention as "melt support". 27/ Allied argued that if anything were read into the claims it should have been "melt support", not wide lips on the casting nozzle. 28/

25/ 35 U.S.C. § 112, second paragraph states:
> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

26/ ID at 64.

27/ See generally, Allied's Petition for Review at 3, 30-34. Allied admits that during the advisory proceeding its counsel agreed not to relitigate the issues decided in the original proceedings. R-TR at 6432-6434. Allied argues, however, that it should not be held to that agreement because the IAO does not follow the ID. Allied Petition for Review at 9. Because this opinion eliminates any inconsistencies between the ID and the Commission's advisory determination, Allied's arguments based on inconsistencies between the ID and the IAO are irrelevant.

28/ Allied's Petition at 50; Allied's Reply in Support of its Petition at 41-48.

Allied further argued that since the prior art was not shown to teach "melt support", [29/] characterization of the '257 invention as "melt support" would result in a finding that the '257 claims are valid, as they were written, under 35 U.S.C. §103.

We reject Allied's arguments for redetermining the scope and validity of the '257 patent claims. Under the doctrine of the law of the case, when a tribunal decides upon a rule of law in a case, that decision should continue to govern the same issues in subsequent stages in the same case. [30/] This doctrine grants courts and administrative bodies the discretion to avoid wasteful relitigation of matters already decided by the tribunal where to do so would not work an injustice. [31/] Allied had a full and fair opportunity to litigate the issues of the scope and validity of the '257 claims in the original investigation. Thus, it would not work an injustice to apply the doctrine of law of the case in these proceedings. We note that claim

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29/ Allied's argument to the contrary notwithstanding, the ID made no determination of whether the prior art taught melt support per se. That issue was not before the Commission in the original investigation. The Commission did, however, determine that the prior art did not teach supporting the melt on wide casting nozzle lips. We note that passages in the ID at 52, 54, and 55 did not refer to the wide lips in their discussion of the prior art. A reading of the entire ID, however, makes it clear that these passages referred to supporting the melt on wide nozzle lips, not supporting the melt per se.

30/ Arizona v. California, 460 U.S. 605, 618 (1983).

31/ See generally, 1B J. Moore & T Currier, Moore's Federal Practice, ¶0.404 (1984).

construction is a question of law, [32/] and thus, the doctrine of the law of the case is applicable in these proceedings. [33/]

Apart from application of the law of the case to these proceedings, we note that Allied agreed not to litigate the issue of claim interpretation in the advisory opinion proceedings. [34/] Indeed, at the conclusion of the original investigation, Allied embraced the claim interpretation necessary to preserve the '257 patent's validity in the original investigation. [35/]

32/ Molinaro v. Fannon/Courier Corp., 745 F.2d 651, 652, 223 U.S.P.Q. 706-07 (Fed. Cir. 1984).

33/ We note that the doctrine has frequently been applied to claim construction rulings in patent cases. See, e.g., Stewart-Warner Corp. v. City of Pontiac, 767 F.2d 1563, 1568, 226 U.S.P.Q. 676, 679 (Fed. Cir. 1985); Perkin-Elmer Corp. v. Computervision Corp., 732 F.2d 888, 900-01, 221 U.S.P.Q. 669,679 (Fed. Cir. 1984), cert. denied, 469 U.S. 857 (1984); and Stearns v. Beckman Instruments, Inc., 737 F.2d 1565, 1568, 222 U.S.P.Q. 457, 459-460 (Fed. Cir 1984).

34/ AO-TR at 385-386. See also note 27.

35/ For example, Allied stated:

> In short, the ALJ properly interpreted Autogiro and properly followed its holding. The ALJ found the word "nozzle" to be ambiguous and used the patent specification to construe this word to include "wide lips". The fault is not with the decision of the ALJ, but with the obvious mischaracterization of that holding by Respondents. No review of this issue is necessary.
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> Allied Response to Respondent's Petition for Review of the Initial Determination at 5.
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> * * * * *
>
> At page 44 of the ID the ALJ has correctly found that "[t]he '257 claims are construed as including the critical feature of the wide lips on the nozzle." The ALJ did not read Dr. Narasimhan's melt

(Footnote continued on next page)

D. Claim Interpretation

In the original investigation, respondents were found to be using casting nozzles with relatively wide lips. Thus, infringement was found because respondents' processes were encompassed by the scope of the claims as interpreted in the ID (i.e. respondents' processes utilized relatively wide lips on a casting nozzle). 36/ In the proceedings now before us, respondents claim that their modified processes employ nozzle lips that are too narrow to be covered by the claims of the '257 patent as interpreted by the Commission. Thus, respondents raise an issue in the advisory proceedings that was not litigated before the Commission in the original investigation, viz., whether casting processes utilizing narrow nozzle lips infringe the '257 patent. 37/ We intend that our resolution of this issue be consistent with the characterization of the invention found in the ID.

As we determined in the original investigation, the term "nozzle" as used in the '257 patent claims is ambiguous as to the structure of the nozzle. To

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(Footnote continued from previous page)
constraint or support result or theory into the '257 process claims. The ALJ went into great detail at pages 62-66 of the ID to explain why it was not necessary for Allied to prove that the Vacuumschmelze wide lips supported or constrained the melt. All that was required from Allied was to show, which it did, that the Vacuumschmelze nozzles have wide lips. (ID 64 and 66).

Allied's Response to Respondents' Petition for Review of the Initial Determination, at 16.

36/ ID at 62-70.

37/ Although the issue was not litigated, the ID stated in dicta "If a respondent used a nozzle without wide lips, infringement could not be found." ID at 64.

resolve this ambiguity we looked to the '257 patent specification. The section of the '257 patent specification labeled "Summary of the Invention" describes the nozzle thusly: "The slot is defined by a pair of generally parallel lips, a first lip and a second lip, numbered in direction of movement of the chill surface. The slot must have a width, measured in the direction of movement of the chill surface, of from about 0.3 to about 1 millimeter." 38/ "The first [nozzle] lip must have a width at least equal to the width of the slot, and the second [nozzle] lip must have a width of from about 1.5 to about 3 times the width of the slot." 39/ We note that the width of the lips of the nozzle is expressly described in the patent specification as a "critical parameter". 40/

We also note that the memorandum of invention filed with Allied's patent department recited specific width limitations for the nozzle lips. 41/ In addition, the testimony of Dr. Narasimhan, the inventor of the '257 process, indicates that the width of the nozzle lips is a critical feature of the'257 process. 42/ Finally, Allied's patent counsel advised an Allied employee, Mr. Wellslager, that he (Wellslager) could not be considered a co-inventor of the Narasimhan process only because Wellslager had not disclosed the specific

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38/ '257 patent Col. 3, lines 37-42.

39/ '257 patent Col. 3, lines 50-53.

40/ '257 patent Col. 3, 49-50.

41/ ID-FF 332, AO-FF 17.

42/ See, ID at 35; Narasimhan deposition taken November 11, 1983, (Allied Exhibit CF) at 65-85, 119-128; and AO-TR 18-22.

configuration of the nozzle lips that Narasimhan had discovered. [43/] Based on the foregoing, we reaffirm that the scope of the '257 patent covers processes for casting amorphous metals which utilize the critical feature of relatively wide nozzle lips. We further construe the wide nozzle lips to be of the dimensions set forth in the "Summary of the Invention" found in the '257 patent specification.

II. Literal Infringement.

Literal infringement requires that the accused device or process embody every element of properly interpreted claims. [44/] For the respondents to literally infringe the claims of the '257 patent, their processes must utilize casting nozzles with back nozzle lips that are at least equal to the width of the nozzle slot and front nozzle lips that are from about 1.5 to about 3 times the width of the nozzle opening. We construe the word "about" to allow a variance of up to .05 at the lower end of the front nozzle lip ratio range. [45/] Thus, in order for respondents' processes to literally infringe the claims of the '257 patent, they must utilize a front casting nozzle lip that is at least 1.45 times as wide as the width of the casting nozzle's

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43/ ID-FF 364.

44/ See Mannesmann Demag Corp. v. Engineered Metal Products, 793 F.2d at 1282, 230 U.S.P.Q. at 46.

45/ Expert testimony indicates that the word "about" used with a number containing two significant figures, such as 1.5, should be interpreted to mean that the figure has a variance of two significant figures, in this case, .05. AO-TR at 486. "[A]bout 1.5" would thus cover ratios of from 1.45 to 1.55.

slot. We do not determine the upper range of nozzle lips that fall within the scope of the '257 patent. That issue is not before us.

A. The New Process of HML Does Not Literally Infringe the Claims of the '257 Patent. 46/

After issuance of the ID, HML developed a new nozzle in its process for casting wide amorphous metal strip. 47/ HML describes its new nozzle as [ ]. 48/ The nozzle's slot [ ] to reduce the width of the front lip, and the back lip was [ ] to make the back lip narrower. 49/ [ ] 50/

Three demonstration runs of the new HML process were conducted in September, 1985, during Allied's inspection of HML's facilities. 51/ Production runs 900, 901, and 902 were made under conditions specified and verified by Allied. 52/ Runs 900 and 902 were conducted under commercial

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46/ The ALJ noted that some of HML's evidence lacked credibility and that HML had misrepresented or failed to disclose certain information. IAO at 35 and AO-FF 53-56 and 71. For that reason, we base our holdings concerning infringement by HML's new process on evidence obtained by Allied during on-site discovery in Japan, on HML's expert testimony which the ALJ found to be credible (IAO at 35), and on Allied's Exhibits.

47/ AO-FF 57; AO-TR at 312-313.

48/ AO-TR at 311.

49/ FF-57; AO-TR at 419-20.

50/ AO-FF-58, AO-TR 437-38.

51/ IAO at 34; AO-TR at 653-654.

52/ AO-FF 77.

conditions. [53] In both run 900 and 902 the nozzle slot width was [ ], and the gap between the chill roll and the nozzle was [ ]. [54] In run 901, the gap between the nozzle and chill roll was varied from that which HML normally used. [55] The measurements of slot width and lip widths for lip No. 1, the back lip and lip No. 2, the front lip, in runs 900, 901, and 902 are as follows: [56]

	Slot width (mm)	(Front Lip) Lip 2 width (mm)	(Back Lip) Lip 1 Width (mm)
Run 900	[ ]	[ ]	[ ]
Run 901	[ ]	[ ]	[ ]
Run 902	[ ]	[ ]	[ ]

Because the front nozzle lip in each run was [ ], we find that HML's new process does not fall within the literal boundaries of the '257 patent claims, and thus, does not literally infringe the '257 patent. Based on the foregoing, we determine that HML is capable of making good quality wide amorphous metal strip in commercial quantities using a process that does not literally infringe the '257 patent.

53/ AO-TR 653-654.

54/ AO-FF 80.

55/ AO-FF 78; AO-TR at 653-654.

56/ See AO-FF 81; Ex. HM-43. Nozzles used in these runs are in evidence as Hitachi Phys. Ex. HM-U (run 900) and HM-W (run 902). AO-TR 483.

B. The New Process of Vac Does Not Literally Infringe the Claims of the '257 Patent.

Vac has [ ] for casting crystalline or amorphous metal, Machines [ ]. [57] Machines [ ] are used to cast wide amorphous metal strip. [58] Vac uses only generally [ ] slotted nozzles on its amorphous metal casting machines. [59] These [ ] nozzles are ground down to [ ] without causing the nozzle material to break away. [60]

Vac workers are instructed to grind the nozzle lips to a size that is [ ]. [61] The Vac employee responsible for amorphous metal operations, [62] testified that he instructs his workers to grind the lips used on Vac's casting nozzles to [ ], but that some nozzle lips are ground as [ ]. [63] By looking at the nozzles with his naked eye, the Vac employee has confirmed that the nozzle lips used in Vac's amorphous metal casting process are [ ] of the width of the nozzle slot. [64] The Vac employee testified that he has verified his observations

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57/ AO-FF 20; AO-TR at 141-3.

58/ Id.

59/ AO-FF 22; AO-TR at 143

60/ AO-FF 27, 29; AO-TR 153.

61/ AO-FF 36; AO-TR at 163.

62/ Dr. Hilzinger. AO-FF 19.

63/ AO-FF 28; AO-TR at 153.

64/ AO-FF 37, AO-TR at 163; See AO-FF 31-33.

by measuring some of the nozzle lips with instruments. 65/ While the nozzle used on [ ] before each run, 66/ the nozzle used on [ ] may be used for more than one run [ ]. 67/ The Vac employee frequently inspects the nozzles of [ ] after the run is completed, and he sometimes inspects the nozzles immediately after [ ]. 68/

The width of the nozzle slot used by Vac [ ] 69/ A typical nozzle slot is [ ]. 70/ Although the slot widths were routinely recorded by Vac prior to the advisory proceedings, 71/ the lips widths were not. 72/ [ ]. 73/

In October, 1985, Vac's new process was demonstrated for Allied's counsel at Vac's plant in Hanau, Federal Republic of Germany. 74/ Two runs were

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65/ AO-FF 39; AO-TR at 167

66/ AO-FF 35; AO-TR at 162.

67/ AO-FF 34; AO-TR at 162.

68/ AO-FF 31-33; AO-TR 159-160.

69/ FF-41; AO-TR at 168, 204.

70/ AO-FF 41; AO-TR at 203.

71/ AO-TR at 167.

72/ AO-FF 40; AO-TR at 167.

73/ AO-TR at 167.

74/ AO-FF 23.

made by Allied's representative, and both runs were successful. 75/ [

]. 76/

Allied's expert witness, determined with the naked eye that the lips on Vac's casting nozzles (Vac Phys. Exhibits VC, VF, VH, and VB) [

]. 77/ He was also able to tell with the naked eye that the nozzle lips of Vac Phys. Ex. VD were [ ] of the nozzle's slot. 78/

Because Vac has demonstrated that its new process uses lips that are [ ], we find that Vac's new process does not fall within the literal boundaries of the '257 patent claims, and thus, does not literally infringe the '257 patent. We therefore determine that Vac is capable of making good quality wide amorphous metal strip in commercial quantities using a process that does not literally infringe the '257 patent.

III. Infringement Under the Doctrine of Equivalents.

The doctrine of equivalents is an equitable doctrine invoked when an infringer seeks to appropriate an invention by making insubstantial

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75/ AO-FF 24; AO-TR 149.

76/ AO-FF 25.

77/ Dr. Mehrabian AO-FF 47; AO-TR at 603-606.

78/ AO-FF 48; AO-TR at 606-607. Vac's Phys, Ex. VC and VD were used in the demonstration runs. AO-TR 148-149.

modifications so as to to avoid the literal language of the patent claims. 79/ Under the doctrine of equivalents an accused product or process will infringe even though it is outside the literal terms of the claim, if it performs essentially the same function in substantially the same way to obtain substantially the same result as the patented product or process. 80/

Equivalence is determined against the context of the patent, the prior art, and the particular circumstances of the case. 81/ The range of equivalents to which a patent claim is entitled depends on whether the patent is a pioneer patent, a small improvement patent, or something in between. 82/ While the doctrine of equivalents can be used to expand patent claims to cover more than what would literally infringe, it cannot be used to expand the patent claims to cover what was in the prior art, 83/ or what was given up by the inventor during prosecution at the U.S. Patent and Trademark Office (PTO). 84/

It is not seriously disputed that the modified processes of the respondents obtain substantially the same result as the process of the '257

79/ See, e.g., Hughes Aircraft Co. v. United States, 717 F.2d 1351, 1361, 219 U.S.P.Q. 473, 480 (Fed. Cir. 1983).

80/ Graver Tank and Mfg. Co., Inc. v. Linde Air Products Company, 339 U.S. 605, 608 (1950) (citing Sanitary Refrigerator v. Winters, 280 U.S. 30, 42 (1929)).

81/ Graver Tank, 339 U.S. at 609.

82/ See, e.g., Autogiro, 384 F.2d at 401, 155 U.S.P.Q. at 705.

83/ Carman Industries Inc. v. Wahl, 724 F.2d 932, 942, 220 U.S.P.Q. 481, 489 (Fed. Cir. 1983).

84/ Autogiro, 384 F.2d at 400-401; 155 U.S.P.Q. at 703-4.

patent, i.e., commercially salable wide amorphous metal strip. 85/ The disputed issues concern whether respondents' processes perform substantially the same function in substantially the same way as does the process disclosed in the '257 patent. The Commission, therefore, must determine whether the narrow casting nozzle lips of the respondents perform essentially the same function as the wide casting nozzle lips of the '257 patent, and whether the narrow nozzle lips used by respondents function in substantially the same way as do the wide nozzle lips of the '257 process.

A. The '257 Process

In the '257 process a slotted casting nozzle which is attached to a crucible containing molten metal is brought close to a rapidly moving chill wheel surface. Melt is forced out of the nozzle at a controlled rate by applying adjustable pressure to the melt held in the crucible. When the melt exits the casting nozzle, it is supported between the bottom of the wide nozzle lips and the solidification front (the place where the molten, liquid metal becomes solid) on the chill wheel. While the metal is held under the lip that is downstream in relation to the direction of the movement of the chill wheel (the front lip) and the upstream lip (the back lip) of the casting

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85/ HML argued before the Commission that a difference in the smoothness of the ribbon made by the HML process shows that the HML process does not achieve the same result as the '257 process. Reply to Allied's and the Commission Investigative Attorney's Petition for Review at 56. We note that the doctrine of equivalents requires only substantially the same results, not identical results, and we agree with HML's original position that differences in quality are not relevant to issues of infringement in this case. See HML's Motion 143-86 "C", Confidential Exhibit B at 11.

nozzle, it is still molten. The molten metal solidifies and forms a ribbon as it contacts the chilled wheel surface and is pulled away. 86/

The '257 patent specification describes the width of the lips on the casting nozzle to be a critical parameter of the '257 process. 87/ The '257 specification indicates that the functions of the wide nozzle lips are stabilization or support of the melt puddle and control of the flow rate of the molten metal. 88/ The inventor's testimony is in accord. 89/ Moreover, the respondents do not dispute that the wide nozzle lips function to support the melt and control the melt flow rate in the '257 process. We therefore determine that the nozzle lips of the '257 patent have two functions: (1) stabilization or support of the melt puddle, and (2) control of the rate of melt flow from the nozzle slot.

According to the testimony of the inventor, the nozzle lips of the '257 invention perform their functions by playing a role in an arrangement that the inventor terms "entrapment geometry". 90/ This arrangement provides the melt support found in the '257 process. 91/ The inventor of the '257 process explained that "entrapment geometry" is a term that describes the

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86/ See generally, ID at 34-36; 59-60; Narasimhan Deposition, Nov. 11-12, 1983 (Allied Phys. Ex. CF) at 70-85.

87/ '257 patent, Col. 3, lines 49-50.

88/ '257 patent, Col.5, lines 6-7; Col. 5, lines 13-20; Col. 6, lines 34-36.

89/ Dr. Narasimhan, inventor of the '257 process. AO-TR 20, 22, 50, 70.

90/ Allied Phys. Ex. CF at 66. Deposition of Dr. Narasimhan.

91/ Id.

trapping or supporting of molten metal between the wide nozzle lips and the solidification front on the chill wheel. 92/ The nozzle together with the condition of the chill substrate forms the geometry. 93/ In the '257 process, the chill substrate condition is such that the melt is completely within the area between the front lip and the rapidly moving solidification front. 94/ The '257 specification states that the solidification front on the chill surface barely misses the downstream end of the second (front) lip. 95/ The front lip is preferably rather flat so that the solidification front is also rather flat. 96/

Front and back nozzle lips are required to provide entrapment geometry. 97/ The molten metal is confined by both nozzle lips. 98/ Although the inventor considers both the front and back nozzle lips to be critical aspects of his invention, 99/ he considers the presence of the front lip to be a more crucial part of his invention than the presence of the back lip. 100/

92/ Id. at 70.

93/ Id. at 50.

94/ Id. at 51.

95/ '257 patent, Col. 5, lines 5-6.

96/ Allied Phys. Ex. CF at 70.

97/ Id. at 66.

98/ AO-TR at 50.

99/ Allied Phys. Ex. CF at 120.

100/ Id. at 128.

There is an outside limit on the width of the front nozzle lip used in the '257 process. If the front lip is too wide it could scrape the hard surface of the solidification front, causing the nozzle to fail. 101/ In the '257 process the back lip supports the molten metal essentially by the pumping action of the melt which results from constant removal of solidified strip. 102/ The inventor does not think that good amorphous metal ribbon can be made if a back nozzle lip with a knife-edge is used in the '257 process. 103/ According to the inventor, if knife-edged blades were used with the same alloys and process conditions that he used, melt would run out the back of the nozzle like BB shot. 104/ The inventor also testified that if one used knife-edged nozzles in his system, one could not support anything. 105/

The inventor testified that in the '257 process the molten metal remains under the nozzle lips and does not extend beyond the lips. 106/ The '257 patent specification indicates that if the melt extends beyond the nozzle lips, the melt flow is not being controlled properly. 107/

101/ '257 patent, Col. 6, lines 16-19; See also Allied Phys. Ex CF at 70-72.

102/ '257 patent Col. 5, lines 6-9.

103/ Id. at 72. The inventor used the term knife-edged to mean lips of a thickness of about .150 mm. CF at 81.

104/ Allied Phys. Ex. CF at 71-72.

105/ Id. at 66.

106/ AO-TR 20.

107/ '257 patent, Col. 9, lines 33-37.

As the inventor defined melt support in his system, the molten metal should touch something more than the slot of the nozzle. 108/ According to the inventor, the slot of his casting nozzle does not provide any support for the melt. 109/ Instead the melt is supported by the "entrapment geometry" of the '257 arrangement. 110/

Based on the evidence of record, we determine that the wide lips of the apparatus used in the '257 process function to support the molten metal and control the melt flow rate by playing a crucial role in an arrangement termed "entrapment geometry".

B. The '257 Patent's Range of Equivalents

The range of equivalents to which a patent claim is entitled depends on whether the patent is a pioneer patent or a minor improvement patent. 111/ In discussing the term "pioneer patent", the Supreme Court stated—

> [t]his word, although used somewhat loosely, is commonly understood to denote a patent covering a function never before performed, a wholly novel device, or one of such novelty and importance as to mark a distinct step in the progress of the art, as distinguished from a mere improvement or perfection of what had gone before. 112/

The metal casting art is fairly old and somewhat crowded as evidenced by the dates and range of the prior art references made of record in this

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108/ AO—TR at 50.

109/ Allied Phys. Ex. CF at 62-64.

110/ Id. at 66.

111/ Autogiro, 384 F.2d at 401, 155 U.S.P.Q. at 705.

112/ Westinghouse v. Boyden Brake Co., 170 U.S. at 561-2.

investigation. [113] Metal casting methods —notably, but not limited to —the melt drag process were used successfully in the prior art to cast wide crystalline strip. [114] As the Commission found in the original investigation, known crystalline metal casting methods constitute relevant prior art in this investigation. [115] In addition, amorphous metal casting methods such as jet casting and double roll casting were known in the prior art. [116] It was not possible, however, to cast wide amorphous metal strip with the jet casting method, [117] and the double roll casting method resulted in amorphous strip with unwanted properties. [118] The Commission examined the prior art in the original investigation and determined that the invention of the '257 patent would not have been obvious in view of the prior art, but only because the Commission construed the '257 claims to include the limitation of relatively wide lips on the casting nozzle. [119]

In the ID, we noted that the invention of the '257 patent solved the problems of melt instability and spattering encountered by the metals industry

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113/ See ID at 49–60.

114/ See ID at 49–57.

115/ See ID at 49.

116/ See '257 patent, Cols. 1 and 2.

117/ '257 patent Col. 2, lines 34–35.

118/ '257 patent Col. 2, lines 61–67.

119/ See ID at 49–60.

in its attempts to cast wide amorphous metal strip. 120/ Allied has argued in these proceedings that the '257 patent is a pioneer patent and is entitled to a range of equivalents that would encompass any method of casting wide amorphous strip that supports the melt. 121/ We acknowledge that the '257 patent represents a significant advance in the art, but we determine that the record in this investigation will not support giving the '257 patent a range of equivalents as broad as Allied urges. We find that the '257 patent represents a significant advance in the casting of amorphous metals and is entitled to a commensurate range of equivalents. We do not find, however, that the '257 patent is a pioneer patent.

C. HML's Process.

HML's expert witness testified that the [

]. 122/ In the HML process, [

]. 123/ HML's expert witness further testified that the [

]. 124/ Allied's expert witness, testified that [

]

120/ See, e.g., ID-FF 308, 310, 318, 323, 367, 383; AO-FF 15.

121/ Allied's Petition at 59-60.

122/ Dr. Grant. AO-TR at 495.

123/ AO-TR at 494.

124/ AO-TR 489.

[

]. He further testified that [

]. [125] An HML employee responsible for HML's production of amorphous metals, testified that there was [

] in the HML process. [126]

Based on the foregoing, we find that the nozzles used in the new HML process [

]. [127] We find that this [

]. We therefore determine that the nozzle lips of the HML process perform [ ] as the nozzle lips of the '257 process.

The record contains films which demonstrate how the new HML process functions, as well as expert testimony which describes the process. [128] Movies taken by Allied during its inspection of HML's facilities show that a

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125/ Dr. Mehrabian AO-TR at 557.

126/ Mr. Arakawa. AO-TR at 381.

127/ AO-FF 62.

128/ For reasons discussed above at footnote 46, we base our findings concerning how HML's process functions on films that were taken by Allied under conditions specified by Allied, expert witness testimony on behalf of both HML and Allied, and exhibits placed in evidence by Allied.

[ ]. [129]

The coloration of the molten metal puddle shown in Allied's Physical Exhibit AY, [130] indicates that [ ] in the new HML process. [131] The new HML process and nozzle permit [ ] in Allied Exhibit AY. [132]

Unlike the '257 process where the [ ], [133] [ ] in the HML process exists [ ] from the second (front) lip. [134] This is [ ] to the teaching of the '257 patent that the melt should [ ] nozzle lips. [135] Allied's expert witness, confirmed that a significant amount of molten metal is shown

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129/ HML exhibits HM-AJ, HM-AK, and HM-AL are movies taken by Allied during an inspection of HML's factory. HM-AL is too dark to easily discern whether [ ].

130/ This exhibit is an enlarged frame taken from a movie that HML made of its process, HML Phys. Ex. HM-A. We rely upon it because it was introduced by Allied.

131/ AO-TR at 489.

132/ AO-TR at 494.

133/ '257 patent Col. 5, lines 5-6. See also discussion above at 22-26.

134/ AO-TR at 449-450.

135/ See the '257 patent, Col., 9, lines 28-36.

[ ], and that solidification of the melt [ ], [142] [ ] to the '257 process where the solidification front is just downstream from the front nozzle lip. [143] The Vac employee also testified that the Vac process operates best if [ ] the nozzle orifice opening. [144]

Photographs of the Vac process indicate [ ] the casting nozzle lips, [145] however, we find that this [ ] necessary for the operation of the Vac process. The [ ] is found on the casting nozzle lips where the molten metal comes out of the nozzle slot and turns the corner at the bottom of the nozzle. [146] It is [ ] the nozzle lips when it turns the corner before it is carried away as solidified ribbon. [147] The [ ] under the lower surface of the lips of the nozzle depends upon factors such as the [ ]

142/ AO-TR at 223-224 and 249-253.

143/ '257 patent, Col. 5, lines 5-6.

144/ AO-TR at 182.

145/ Vac Exhibits V5 through V12.

146/ AO-FF 43.

147/ See AO-FF 43; AO-TR 746, 748-749.

[

] of the nozzle lips. 148/

We acknowledge that optical distortions may exist in the Vac photographs which make [

] than it really is. These distortions could account for errors in the actual [ ] of plus or minus 100–200 microns (0.1mm – 0.2 mm). 149/ However, even with such distortions taken into account we find that [ ] in the Vac process [

] to any significant degree. In comparison to the total size of the melt puddle [

] the nozzle lips in the Vac process.

Based on the foregoing, we find that the nozzle lips of the Vac process do not perform substantially the same function as do the nozzle lips of the '257 process. Vac's process is not a mere variation of the '257 process. Indeed, Vac has rejected the critical feature of the '257 patent as it was determined in the original investigation and stated in the patent specification — the use of wide nozzle lips to support the molten metal in an amorphous metal casting process. In view of our finding, it is unnecessary to

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148/ AO–44; AO–TR 269–279, 597.

149/ AO–TR at 173–174.

[ ] from the second (front) lip in Allied Phys. Ex. AY. 136/ HML's expert testified that [ ] from the nozzle lips indicated that a very significant part of the solidification of the molten metal into ribbon takes place [ ] the lip area in the HML process. 137/

In the HML process the [

]. This results in the [

]. This [

] solidifying ribbon being produced in contact with the chill wheel surface. 138/ [

] there is an opportunity for any defects on the surface of the metal to be eliminated. The [

] working on it. [ ] permits the molten metal material [ ] and to rid itself of small surface pertubations such as striations in the surface which can come about very easily due to defects in the lip or due to the bottom edge of the lip itself. 139/ HML's employee testified that as a result of [ ]

136/ AO-TR at 673-674.

137/ AO-TR at 499.

138/ AO-TR at 495-496.

139/ AO-TR at 490; 494-495

[ ], an improved surface condition for the ribbon formed is obtained. 140/

Based on the foregoing, we find that the HML process does not function by using the "entrapment geometry" arrangement of the '257 patent. HML does not [ ] to the area between the nozzle lips and the solidification front. Allied's movies of the HML process, as well as expert testimony, show that the molten metal [ ] the edge of the front nozzle lip, and that solidification takes place [ ].

We find that the nozzle lips of HML do not function in the same way as the nozzle lips of the '257 patent. HML's process is not a mere variation of the '257 process. Indeed, HML has rejected the critical feature of the '257 patent as it was determined in the original investigation and stated in the patent specification—the use of wide nozzle lips to support the molten metal in an amorphous metal casting process. We therefore determine that HML is capable of manufacturing amorphous metal strip in commercial quantities using a process that does not infringe the '257 patent under the doctrine of equivalents. In view of our infringement findings, we do not reach the issue of whether HML's new process is taught by the prior art.

D. Vac's Process

A Vac employee testified that [ ] in the functioning of the Vac process. 141/ He further testified that the [ ]

140/ Mr. Arakawa. AO—TR at 422.

141/ Dr. Hilzinger. AO—FF 42; TR 206.

discuss the way in which the nozzle lips function in the Vac process, or whether they have any special function at all.

We find that Vac is capable of casting good quality wide amorphous metal strip in commercial quantities using a process which does not infringe the claims of the '257 patent.

ALLIED'S MOTION FOR ADMISSION OF NEW EVIDENCE

While the advisory opinion proceedings were before the Commission, Allied filed a motion to admit new evidence that Allied claimed would show that HML lacked general credibility and could not be trusted to comply with certification procedures. (The exclusion order modification proceedings could result in importation of amorphous metal products under certification that the products were not made by infringing processes). Allied also requested sanctions against HML for misleading the Commission, an allegation that Allied argued would be proved by the new evidence. 150/ The Commission referred this motion to the ALJ when it remanded the proceedings for additional findings. The ALJ admitted all of the new evidence and held an evidentiary hearing based on the new evidence. The ALJ determined that the new evidence did not establish that HML lacked credibility, nor did it prove that sanctions were warranted. We adopt the ALJ's determination concerning Allied's motion.

CONCLUSION

For the reasons discussed above, we determine that the modified processes which respondents HML and Vac have brought before the Commission would not

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150/ See Motion 143-120 "C".

infringe the '257 patent if practiced in the United States, nor would importation of amorphous metal made by these processes violate the exclusion order issued at the end of Investigation No. 337-TA-143.

Certificate of Service

I, Kenneth R. Mason, hereby certify that the attached PUBLIC VERSION OF NOTICE OF ISSUANCE OF ADVISORY OPINIONS, VIEWS OF COMMISSION, was served upon Steven Schwartz, Esq., and Stephen Sulzer, Esq., and upon the following parties via first class mail, and air mail where necessary on May 29, 1987.

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[PUBLIC VERSION #2]

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In the Matter of	)	
	)	
CERTAIN AMORPHOUS METAL ALLOYS AND AMORPHOUS METAL ARTICLES	)	Investigation No. 337-TA-143
	)	
	)	

INITIAL ADVISORY OPINION

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TABLE OF CONTENTS

1. History of the Case

In 1976, Allied Corporation filed a patent application based on an invention of Dr. Mandayam C. Narasimhan. (Ex. P-294.) Eventually, three separate patents issued, the '739 strip patent, the '571 apparatus patent, and the '257 process patent, the only patent involved here.

On March 11, 1983, Allied filed a complaint with the U.S. International Trade Commission alleging, among other things, that certain foreign companies had imported amorphous metal strip made by a process that would infringe Allied's '257 patent if the process were used in the United States, thereby engaging in unfair practices under Section 337 of the Tariff Act of 1930.

After a hearing, an initial determination was issued on May 14, 1984, and was adopted as its decision by the Commission on July 6, 1984. Part of the Commission's decision was appealed to the U.S. Court of Appeals for the Federal Circuit, but that appeal (not involving the '257 process patent) was dismissed on January 21, 1986.

The Commission found that the '257 patent was valid and that certain respondents had engaged in unfair acts violating Section 337 of the Tariff Act in connection with the importation into the United States of amorphous metal products. The Commission then issued an exclusion order.

On February 22, 1985, the Hitachi respondents (Hitachi) filed a motion requesting modification of the exclusion order to allow Hitachi's amorphous metal strip to be imported or, in the alternative, requesting an advisory opinion that would allow Hitachi's products to be imported. (Motion 143-86 "C".) On May 29, 1985, Vacuumschmelze (Vac) filed a similar motion (Motion 143-89 "C").

The '257 patent described a process for making continuous amorphous metal strip with a relatively uniform width at least 7 mm wide. (Col. 4, '257 patent, Allied Exh. 19.) Although the '257 patent claims are not expressly limited to strip at least 7 mm wide, all of the products in issue in this advisory opinion are at least 7 mm wide.

On July 6, 1984, the Commission found that the '257 patent would have been invalid under Section 103 of the Patent Act in light of the prior art if claim 1 were read literally. Claim 1 was so broad that the process it described would have been obvious to one with ordinary skill in the art at the time that the alleged invention was made. The Commission found that the '257 patent was valid only after finding that the word "nozzle" and the phrase "slotted nozzle" as used in the '257 patent claims were ambiguous as to the structure of the nozzle. Since the word "nozzle" as used in the claims was ambiguous, the patent specification could be used to construe this word. The word "nozzle" in the '257 patent claims then was construed in the context of the patent specification as requiring lips with a certain width relative to the size of the nozzle opening. The Commission found that without this limitation on the claims, the patent would have been invalid under Section 103 of the Patent Act. The decision indicated that if the respondents made amorphous metal by the method described in the '257 patent, but they did not use "wide" lips on the nozzle relative to the size of the nozzle opening, as construed in the context of the patent specification, they would not infringe the '257 patent.

After July 6, 1984, Vacuumschmelze and the Hitachi respondents started to use nozzles that were ground down to a narrow point, so that the end of the nozzle had narrow lips. These nozzles were used successfully to make wide

amorphous metal strip. These-respondents now contend that they can make wide amorphous strip in commercial quantities by a process that does not infringe the '257 patent.

After granting the motions of Hitachi and Vacuumschmelze, the Commission instituted advisory opinion proceedings under Section 211.57 of the Commission's Rules of Practice, and delegated the matter to an administrative law judge for an adversary proceeding and for the issuance of an initial advisory opinion on this question.

The Commission also ordered a proceeding for consideration of modifying the exclusion order, and authorized the consolidation of the Vacuumschmelze and Hitachi motions. The two motions were consolidated.

One question raised was whether the motions required relitigation of issues barred by the doctrine of res judicata or the doctrine of collateral estoppel. The entire record in this case was reopened, so that these two issues are no longer raised, although all parties agreed that the issues decided in the original case would not be relitigated.

A joint hearing was held on the advisory opinion issues and on the question of modification of the exclusion order. This initial advisory opinion relates only to the advisory opinion issues.

A separate recommended determination relates to the question of whether the exclusion order should be modified. The general issue presented there is whether there is a practical way to write and enforce an exclusion order that will exclude only wide amorphous metal made by a process that infringes the '257 patent. The issue of whether it is possible to ascertain whether an importer is using the old process or a new process in any particular shipment imported into the United States is also discussed.

The general issue presented by this advisory opinion is whether the Hitachi and Vacuumschmelze respondents are capable of manufacturing in commercial quantities amorphous metal strip of good quality by casting processes that have been modified enough to avoid infringement of the '257 process patent (i.e., by using a process to make an imported product that would not infringe the '257 patent if that process were used in the United States).

2. Construction of the '257 Patent

The Commission's construction of claim 1 of the '257 patent incorporates certain limitations from the patent specification into the claim. This construction is important to the infringement issues raised in this proceeding because if claim 1 were read literally, some of respondents' new processes would infringe the claim. When the Commission incorporated certain limitations from the patent specification into the claim, these processes would not infringe the patent, unless they infringe under the doctrine of equivalents. The parties agreed not to relitigate the issue of literal infringement, but the new processes of respondents raise new factual issues under the doctrine of equivalents.

The patent specification also is important because it is there that the inventor has included a clear definition of his invention, and has made a distinction between the invention itself and various modes of practice of the invention. This is relevant to a determination of scope of the patent under the doctrine of equivalents.

Claim 1 of the '257 patent reads as follows:

> 1. A method of forming continuous strip of amorphous metal from a molten alloy capable of forming an amorphous structure comprising:
>
> a. forcing the molten alloy under pressure through a slotted nozzle positioned generally perpendicular to the direction of movement of a chill surface and located in close proximity to the chill surface to provide a gap of from about 0.03 to about 1 millimeter between said nozzle and the chill surface;
>
> b. advancing the chill surface, at a predetermined speed; and
>
> c. quenching the molten metal in contact with the chill surface at a rapid rate to effect solidification into a continuous amorphous metal strip.

Claim 1 of the '257 patent was held to be invalid under Section 103 of the Patent Act, if read literally, because claim 1 is so broad that the process it describes would have been invalid under Section 103 of the Patent Act as obvious to one with ordinary skill in the art at the time of Dr. Narasimhan's invention.

The word "nozzle" in claim 1 was found to be ambiguous because the configuration of the nozzle, including the relative width of each nozzle lip in comparison to the size of the opening in the nozzle, was not clear from reading the claim. The relative width of each nozzle lip was described in the summary of the invention in the patent specification as a critical element of the Narasimhan invention. The Commission found that the ambiguity in the word "nozzle" in the claim, read in the context of the '257 patent, could be construed by referring to the patent specification.

Claim 1 had claimed far more than the invention. By construing claim 1 in the light of the specification, Dr. Narasimhan's invention as he himself described it both in his testimony and in the patent specification was protected by the patent.

In columns 3 and 4 of the patent specification there is a "summary of the invention." This is a general description of the invention, and is not part of the "detailed description of the invention and the preferred embodiments" that are described in the rest of the specification, starting at the bottom of column 4. There is no support for the argument that the general description of the invention in column 3 and at the top of column 4 refers only to preferred embodiments of the invention, rather than to a description of the essential elements of the invention as understood by the inventor and intentionally conveyed to the reader. The preferred embodiments are described later, at the bottom of column 4.

At the top of column 3, the "summary of the invention" describes the invention as a discovery that if a thin uniform layer of molten metal is mechanically supported on a chill surface by a certain method, it becomes possible to draw out thin metal strips in various widths and thicknesses. To do this, the invention provides for use of a movable chill body (the chill wheel), a slotted nozzle in communication with a reservoir for holding molten metal, and means for effecting expulsion of the molten metal from the reservoir through the nozzle to the chill surface. This part of the specification makes it clear that the invention involves the mechanical support of the melt on a chill surface by a certain method. Then, the specification discloses the method to be used: supporting the melt between the chill surface and the relatively wide lips of the nozzle. (The specification also provides that the chill surface shall operate within certain high speed ranges, so that the metal can be cooled quickly enough to remain amorphous, and heating means to keep the metal above its melting point before reaching the chill surface. These concepts were not new.)

It is in the description of the slotted nozzle at lines 35 through 54 of column 3 that the unique method of supporting the melt between the chill surface and the relatively wide lips of the nozzle is found:

> The slotted nozzle is located in close proximity to the chill surface. Its slot is arranged perpendicular to the direction of movement of the chill surface. The slot is defined by a pair of generally parallel lips, a first lip and a second lip, numbered in direction of movement of the chill surface. The slot must have a width, measured in direction of movement of the chill surface, of from about 0.3 to about 1 millimeter. There is no limitation on the length of the slot (measured perpendicular to the direction of movement of the chill surface) other than the practical consideration that the slot should not be longer than the width of the chill surface. The length of the slot determines the width of the strip or sheet being cast.
>
> The width of the lips, measured in direction of movement of the chill surface, is a critical parameter. The first lip has a width at least equal to the width of the slot. The second lip has a width of from about 1.5 to about 3 times the width of the slot.

In an imaginary drawing of a nozzle over a chill wheel that is moving to the right, the first lip (or the back lip) is at the bottom of the nozzle on the left. The second lip (or the front lip) is at the bottom of the nozzle on the right. The strip starts to form at the solidification front on the right side, as the melt begins to solidify as it moves to the right in the direction that the wheel is turning. See Figure 1 of the '257 patent, Allied Exh. 19.

In the summary of the invention in the patent specification, the slot must have a width, measured in direction of movement of the chill surface, of from about 0.3 to about 1 millimeter. The width of the lips is expressly described as a "critical parameter." The first lip must have a width at least equal to the width of the slot, and the second lip must have a width of from about 1.5 to about 3 times the width of the slot. It is by means of these wide lips that the "molten metal is mechanically supported on a chill surface" as the invention was summarized in lines 11 and 12 of column 3.

Later in the patent specification (in the columns giving a detailed description of the invention and the preferred embodiments), the inventor describes his concept of how his invention works. The description of the way in which the molten metal is "supported" by the lips of the nozzle does not describe the structure or shape of the "nozzle," the only word that had been found to be ambiguous in claim 1. The back lip is described as supporting the melt essentially by the "pumping action" of the melt resulting from constant removal of solidified strip. The specification indicates that the rate of flow (of the melt) is controlled by the forming solidification front and the front lip that mechanically supports the molten metal below it. In this embodiment of the invention, the melt is supported between the first nozzle lip and the solidification front, rather than between the first nozzle lip and the chill surface itself.

This part of the specification also gives the preferred measurements of the nozzle lips within the required ranges. It provides that the back lip must be at least about equal to the width of the slot, preferably at least about 1.5 times the width of the slot. If the back lip is too narrow, according to the specification the molten metal will tend to ooze out, and no strip or only irregular strip will be formed. The specification also indicates that in the preferred embodiment the front lip should be about 1.5 to about 3 times the width of the slot, and that if this lip is too narrow, it will fail to provide adequate support to the molten metal and only discontinuous strip will be produced. The suggested preferred embodiments and description of how the inventor thinks that "melt support" works in this part of the specification are not essential elements of the Narasimhan invention.

There is nothing in claim 1 that clearly refers to supporting the melt in any context. There is nothing ambiguous in claim 1 that could be construed as requiring the melt to be "supported" in some manner between the bottom of the lips of the nozzle and the chill surface. Claim 1 broadly claimed a method of forming amorphous metal strip by forcing molten alloy through a slotted nozzle positioned close to the moving chill surface. The essential and novel elements of the Narasimhan invention are not even hinted at in claim 1.

To be consistent with the description of the invention in the "summary of the invention," the Commission construed the ambiguous word "nozzle" in claim 1 as requiring the back lip of the nozzle (lip 1) to have a width at least equal to the width of the slot, and as requiring the front lip (lip 2) to have a width of from about 1.5 to about 3 times the width of the slot. (The approximate measurements of the slot are also described in the summary of the invention in the specification as an essential part of the nozzle measurements and a required part of the invention, and also are read into the ambiguous word "nozzle" in claim 1.)

3. The Narasimhan Invention

Both respondents now have some nozzles with narrow lips that can be used in casting wide amorphous metal strip. Even though the lips are narrow, at least a part of the front lip touches the melt at the corner of the nozzle opening. If the Narasimhan invention requires the use of relatively wide lips, respondents are not infringing the '257 patent. If the Narasimhan invention requires only that there be "melt support," and not "wide lips," Allied can argue that respondents are infringing the '257 patent under the doctrine of

equivalents.

Allied and the Commission investigative attorneys generally take the same position in this case. The positions of both of these parties sometimes are referred to as Allied's positions.

What is the Narasimhan invention? Allied argues that the invention is supporting the melt on the lips of the nozzle, regardless of how narrow the lips are. Under Allied's theory, the Narasimhan invention does not require the use of nozzle lips of any particular width as long as the lips "support the melt." Allied argues that if the nozzle lips are wide enough so that any melt touches the lip, the lip is "supporting the melt." (Allied does not require that the melt be supported between the lip and the chill surface or the solidification front.) Allied argues that unless the melt is "supported," the melt puddle will be unstable. Anyone casting amorphous metal strip successfully therefore must be supporting the melt on the lips of the nozzle, and must be using the Narasimhan invention.

The Commission already has construed claim 1 as requiring the use of wide lips. Allied does not dispute the requirement for wide lips, but only the definition of what "wide" means. Anything wide enough to "support the melt" is adequate, from Allied's point of view.

Vacuumschmelze points out that the tiny amount of melt present on the bottom of its nozzle lips had to be present in the prior art. Some melt is going to touch the front nozzle lip when the melt turns the corner and is carried away on the moving wheel surface. The process of casting metal coming from a nozzle close to the moving chill surface was well known in the prior art. Allied did not describe this much melt on the nozzle lip as "melt support" in the original proceeding.

The most compelling argument in favor of the position of the respondents, however, is that claim 1 of the '257 patent makes no reference to supporting or constraining the melt, and claim 1 is not ambiguously worded with respect to such a function. If claim 1 is not ambiguous, and if no limitations can be read into it from the patent specification to clarify the ambiguity, it is invalid.

What does the word "critical" mean in the patent specification? Does it limit the width of the lips to the precise measurements mentioned in the patent specification? Clearly not. Although the dimensions of the nozzle lips are referred to as "critical" in the specification, the word "about" is used to describe these dimensions, and the ratio of the width of the nozzle lips to the width of the nozzle opening is more important than the precise measurements. The word "critical" therefore is used not to limit the invention to the precise measurements of nozzle lips found in the patent specification. The word "critical" is not used in the patent specification to mean that the invention would not work if these measurements were not used. The word "critical" is used to indicate that nozzle lips of a certain relative width are essential to the invention.

By reading the somewhat vague dimensions of the nozzle lips as described in the patent specification into claim 1, the Narasimhan invention (if the key to that invention is the wide lips) is protected. If the Narasimhan invention were only the concept of "melt support," regardless of the width of the lips, then the invention could not be protected by construing an ambiguous phrase in the claim, and the whole patent would be invalid.

A new issue is raised for the first time in this proceeding. This is whether claim 1 of the '257 patent can be read as broader in scope than the

construction given to claim 1 in the Commission's decision by using the doctrine of equivalents, when the question of whether a particular process now used by respondents infringes the '257 patent is under consideration. Under that doctrine, it is necessary to define the Narasimhan invention as a whole, and not just to read certain aspects of the invention described in the specification as "critical" into an ambiguous word in claim 1. Under the doctrine of equivalents, an effort must be made to read the patent claims broadly enough to protect the Narasimhan invention even if the claims otherwise would be read more narrowly than the invention.

The invention was described by Dr. Narasimhan in the first hearing and in his deposition in a way that is consistent with the description in the patent specification under the heading "summary of the invention." The Narasimhan invention is a process for casting amorphous metal strip in which a nozzle with two relatively wide lips (lips that are of a certain minimum width relative to the width of the nozzle opening) is brought down close to a rapidly moving chill wheel surface, and the melt is pushed out of the nozzle opening where it is then supported between the bottom of a wide nozzle lip and the chill surface or between the bottom of a wide nozzle lip and the solidification front, allowing wide amorphous metal strip to be cast without the melt puddle becoming unstable and the melt spattering. A novel part of the process was the use of wide lips. This enabled Dr. Narasimhan to cast wide amorphous strip without the melt spattering.

Dr. Narasimhan's testimony at the first hearing, his deposition testimony, and the description in the patent specification are consistent with this definition of the invention.

The evidence in the first and second hearings showed that there are a number of elements that go into the successful casting of wide amorphous metal strip on a chill wheel. These factors include the speed of the wheel, the amount of pressure on the melt, the distance between the bottom of the slotted nozzle and the chill wheel surface, the width of the bottom side of the two lips of the nozzle, the width of the opening of the slot in the nozzle, and to a lesser extent the viscosity of the melt and the texture of the surface of the nozzle lips. Each of these factors is related to all of the others.

The patent specification indicates that the melt is not "primarily controlled" by the size of the nozzle opening, but this assumes that all of the other factors are reasonably adjusted to the size of the nozzle opening. (Vacuumschmelze notes that the size of the opening determines the thickness of the strip in its process, but there is little "melt support" in that process.) Although Allied argues that the nozzle opening plays no role in supporting the melt, the patent specification states that this opening must have a width of from about 0.3 to 1 millimeter. If the summary of invention requires this slot width, and Allied contends that the heart of the invention is supporting the melt, why does Allied state that the nozzle opening has no role in supporting the melt? Probably because the respondents are going outside of these nozzle opening limitations. The width of the nozzle opening is important to the Narasimhan process. For example, if the opening is wide and there is a lot of pressure on the melt, too much melt is going to come down, and the melt will ooze out the back and may spatter in front if the front lip is not wide enough (unless one of the other factors, such as wheel speed is changed). If the nozzle opening is too narrow, and not enough melt is coming down, the melt puddle will be starved. There will be less melt

support between the nozzle lip and the wheel surface because the melt will fall on the wheel but not necessarily be confined between the wheel surface and the nozzle lip.

As for the other factors, if the gap between the nozzle and the wheel surface is small, there is more resistance to the melt, and the extension of melt on the bottom of the nozzle lips may decrease. If the gap is increased to the point that the bottom of the nozzle lip no longer touches the melt, there would be less melt support or constraint, although some melt might still touch the bottom surface of the front lip as the melt turns the corner.

An increase in pressure on the melt would tend to increase the melt extension between the front lip and the wheel surface and between the back lip and the wheel surface. The amount of melt available, the wheel speed, the consistency of the melt, the texture of the nozzle surface, and the size of the nozzle opening also would vary the effect of the amount of pressure on the melt.

If the wheel speed is increased, the melt extension may be smaller, or where there is little melt support, as in the Vacuumschmelze process, the strip may not be as thick.

The configuration of the bottom of the nozzle lips is important when more melt goes into the melt puddle below the nozzle, and the amount that leaves the melt puddle as the wheel carries the melt or the cast strip away is unchanged. Too much melt can spatter or cause poor quality strip to be formed. Too little melt, unless all of the other factors are carefully controlled, can result in the air coming around the wheel breaking up the melt puddle under the back nozzle lip. Dr. Narasimhan discovered that if he used wide nozzle lips, he could have enough melt between the back nozzle lip and

the wheel surface to keep the air from breaking up the melt puddle at the back end of the nozzle. The extra melt in the puddle could be handled without spattering at the front end where the strip was being made if he had a wide front lip as well, to support the extra melt between the front nozzle lip and the solidification front or the wheel surface, so that the melt puddle did not become unstable and spatter at the front end of the nozzle.

Dr. Narasimhan's important early contribution to this art was the discovery that good quality wide amorphous metal strip could be cast successfully when molten metal was pushed under pressure (so that there would be enough melt), through a nozzle having wide lips at the bottom of the nozzle, if the nozzle was brought close to the surface of a chilled wheel moving at a speed fast enough to allow amorphous metal to be formed. The same method had been practiced by others in casting crystalline metal, with two exceptions:

(1) The chill wheel had to move faster than to cast ordinary crystalline metal. Those with ordinary skill in the art at the time of the invention were aware of this fact.

(2) The idea of using wide lips on the nozzle. There was no evidence that anyone had been aware previously of any advantage in using this novel idea of Dr. Narasimhan.

It appears that more variation may be possible in the other elements if the bottom side of the nozzle lips is relatively wide so that it can support excess melt and keep it stable between the wide nozzle lip and the chill wheel surface (or the solidification front that rests on the chill wheel surface).

The evidence at the second hearing shows that good quality wide amorphous metal strip now can be made successfully with relatively narrow lips on the

nozzle, if care is taken to adjust the other casting factors in relationship to one another. By making fine adjustments to the amount of pressure on the melt, the size of the nozzle opening, the speed of the chill wheel (which must be fast enough so that amorphous metal will be formed, but can be varied after that speed is reached), and the amount of space between the bottom of the front nozzle lip and the solidification front, amorphous metal strip of uniform width and of various thicknesses can be made without using wide lips on the nozzle. By making precise variations in the other factors, it is possible now to make wide amorphous metal strip without the wide lips of the Narasimhan process.

Dr. Narasimhan's invention was especially important in the early efforts to cast wide amorphous metal strip and is still important in casting wide amorphous metal strip when one does not know how to control all the other factors or when one does not want to use extreme care in controlling all of the other factors critical to the casting.

4. How Wide Must the Lips of the Nozzle Be?

Relatively wide lips are a necessary part of the Narasimhan invention and the casting process covered by the '257 patent. How wide must these lips be? The '257 patent specification states how wide Dr. Narasimhan, the inventor, thought that the lips should be, both as a minimum width and within an approximate range.

Allied takes the position that "wide" lips mean any width that is adequate "to support" or touch the melt, and it argues that if it is possible to cast wide amorphous metal strip successfully, the melt is being supported. This is

not how Dr. Narasimhan described his invention. While he was trying nozzle lips of various sizes, he made many experiments that were unsuccessful, where the melt had spattered dangerously or "gone against the wall." In those experiments he had made his own crucibles from fused quartz, and he could grind the nozzles to the dimensions for lip widths and nozzle slot openings that he wanted to try. The most narrow lips that he tried were when he ground the nozzle lips so that they were about the width of the sides of the quartz tube he was using; about .150 millimeters wide. (Narasimhan deposition TR 81, Allied Phys. Ex. CF.) At that width, he could not make good quality continuous wide strip. (Allied Phys. Ex. CF, pp. 76-81.) He could not actually grind the nozzle lips to a "razor's edge," or to a "knife-edged" point, although he described the narrowest nozzle lips he could make as "knife-edged." It was when Dr. Narasimhan used much wider lips that he was able for the first time to cast good quality wide amorphous metal strip. For example, he testified that it might be possible to make amorphous metal strip with narrow nozzle lips, but the strip would not be of a quality that he would want anyone to see. (Allied Phys. Ex. CF, at 82.) He testified that a narrow back lip would result in "bee bee shots" coming out the back (Allied Phys. Ex. CF at 74 and 81), and that he ran experiments showing that the back lip could be no narrower than the width of the throat (the nozzle opening). (Allied Phys. Ex. CF at 124.)

Dr. Narasimhan's break-through was to use nozzle lips that were wider than those he had used previously in his early unsuccessful experiments. To Dr. Narasimhan, "wide" meant considerably wider than the nozzle lips previously tried by Dr. Narasimhan, not anything wider than a surgeon's knife. (Allied Phys. Ex. CF at 82.) "Wide lips" do not include <u>any</u> nozzle

lips that now can be used to cast wide amorphous strip, after years of additional experimentation have disclosed precise relationships between casting elements, so that wide lips are no longer essential.

The record shows that nozzles can be ground down to a relatively fine point, but that the material ordinarily used by respondents for their nozzles broke when an attempt was made to grind them to a point as sharp as a razor's edge or a knife's edge. It was possible to grind these nozzles to much narrower points than those described in the '257 patent specification, and they worked successfully. The lips of respondents' nozzles always touched some melt, but it is no longer necessary to use the wide lips described in the '257 patent to cast wide amorphous metal strip.

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For literal infringement of the '257 patent, the nozzle opening must be at least about 0.3 to about 1 millimeter wide. The width of the back nozzle lip must be at least equal to the width of the nozzle opening. The width of the front lip must be from about 1.5 to about 3 times the width of the nozzle opening.

Dr. Grant testified that the word "about" would allow a variance of up to .05, in the context of numbers with two significant figures, such as 1.5.

Thus, a variance in the ratio of lip width to slot width of .05 would be allowed for the front lip of the nozzle. A front lip that is 1.45 times the width of the nozzle opening would be covered by the '257 patent.

The Narasimhan invention called for a back lip wider than the slot opening to prevent the melt puddle from being broken up by the air coming around the wheel, and to prevent extra melt from oozing out. The word "about" was not used for the back nozzle lip. A back lip less wide than the width of the slot opening would not be expected to work in the way the specification described the function of the back lip, unless other factors had changed, for example if the melt puddle had become smaller and the pressure on the melt had decreased. In other words, a process using a back lip more narrow than the width of the nozzle opening probably would be different from the one invented by Dr. Narasimhan, and if it worked, it would not be because of Dr. Narasimhan's invention.

Under the doctrine of equivalents, Allied argues that even narrower lips would be covered by the '257 patent than would result from a broad construction of the word "about." The doctrine of equivalents would cover narrow nozzle lips, if the lips would still perform substantially the same function in substantially the same way to obtain substantially the same results as the patented process.

5. The Doctrine of Equivalents

The doctrine of equivalents is set forth in Graver Tank & Mfg. Co. v. Linde Air Products Co., 339 U.S. 605, 85 USPQ 328, 330-332 (1950). In that case the Supreme Court recognized that to permit imitation of a patented

invention that does not copy every literal detail would be "to convert the protection of the patent grant into a hollow and useless thing." From the beginning this doctrine was recognized as overriding under certain circumstances the patent law principle that the claim is the measure of the patent protection. When one applies the doctrine of equivalents, protection is given beyond literal infringement of the claim. Under the doctrine of equivalents, infringement sometimes can be found if the allegedly infringing process performs substantially the same function in substantially the same way to obtain substantially the same results as the patented process.

The two questions raised here are:

(1) whether Allied can use the doctrine of equivalents to expand the scope of claim 1 (construed in the context of the patent specification) to cover nozzle lips that are more narrow than the widths specified in the patent specification as critical, and

(2) if claim 1 can be expanded under the doctrine of equivalents, how far can it be expanded?

The doctrine of equivalents cannot be used to expand the scope of the patent so far that it incorporates what was already in the public domain or what would have been obvious at the time of the invention to one with ordinary skill in the art.

One factor to be considered in determining the degree to which the doctrine of equivalents will be used to expand the scope of the claim beyond the literal terms of the claim is the importance of the invention. A patent on a pioneer invention is entitled to a broader construction than a patent on a narrow improvement in a crowded field. The degree to which the doctrine of equivalents should be used also depends upon the full description of the

invention in the patent specification, more than upon what appears only in the patent claim.

The Narasimhan invention made an important contribution to the art. It was certainly more than a minor improvement in a crowded field, although it falls short of a "pioneer invention." Its basic value was in covering up the mistakes when casting wide amorphous metal strip was in its infancy. In the early experiments, those experimenting were not sure how much pressure to put on the melt, or precisely how other casting factors should be controlled.

Even if Dr. Narasimhan's invention were described as a pioneer invention, the doctrine of equivalents could not be used to expand the scope of the patent so far that it would take out of the public domain information that was in the public domain at the time of the invention, nor could it be used to cover something that would have been obvious to those with ordinary skill in the art at the time that the invention was made. Giving the patent as broad a scope as possible under the doctrine of equivalents still would not allow the patent to cover nozzles with lips of about the same width as the lips on the type of nozzles used by others working in the field of metal casting before Narasimhan had the idea of making the nozzle lips wider.

The doctrine of equivalents can be used to expand the '257 patent to cover what Dr. Narasimhan actually invented: the process of using relatively wide lips on a nozzle held close to the rapidly moving chill surface to cast wide amorphous metal strip, and supporting the melt between the nozzle lips and the chill surface or the solidification front.

The description of the widths of the nozzle lips in the "summary of the invention" in the patent specification as "critical" under certain circumstances would be read as strictly limiting the degree to which one can

expand the scope of claim 1 beyond the measurements given. This would be the case if the invention would not work if there were any variance from the precise measurements described as "critical." If the word "critical" were given this meaning in the '257 patent specification, however, it would be inconsistent with the use of the word "about." The word "about" permits some variance from the precise measurements given. Moreover, the relative width of the nozzle lips to the width of the nozzle opening is more important to the invention than the precise measurements suggested in the "preferred embodiments" section of the patent specification. The meaning of the word "critical" in this context allows the doctrine of equivalents to be used to expand the scope of the patent beyond the precise measurements given in the patent specification.

The Commission investigative attorneys raise an interesting argument for finding infringement under the doctrine of equivalents, to the effect that Dr. Narasimhan's invention incorporated wide nozzle lips because that was the "best method" known to him to support the melt when casting wide amorphous metal strip at the time he filed his patent application. The staff argues that since technical knowledge has improved, it is now known that wide amorphous metal strip can be cast with narrow nozzle lips. The staff argues that this "unimportant variation" (changing from wide to narrow lips) made possible by advances in the art does not save respondents' processes from infringement of the '257 patent. The staff cites three cases in support of its position:

In Kolene Corp. v. Motor City Metal Treating, Inc., 307 F. Supp. 1251 (E. D. Mich. 1969), aff'd, 440 F. d 77 (6th Cir. 1971), the Court of Appeals affirmed the district court's finding of infringement based on the doctrine of

equivalents. The patent claimed a process in which metal was immersed in a bath containing between about 25% and 40% cyanate. The allegedly infringing product contained 46% to 50% cyanate.

The district court found that the upper limit of the range was not "critical" from an operating point of view, and that the upper limit was not a critical limitation of the inventive concept. The court noted that the patent was on a process, not on the particular means by which the method was practiced.

On appeal, the Court of Appeals held that a defendant had a legitimate right to "design around" the patent, but here the defendant had done nothing more than appropriate the patentee's idea. The court described the lower limit of the range found in the patent claim (25%-40%) as "operational", i.e. the process would not achieve the desired result if less than 25% of the bath was cyanate. The court described the upper limit as "practical." Because of a sludge problem, it was not economical at the time of the application for a patent to use more than 40% cyanate in the bath. Later, when the sludge problem was solved, the process would operate economically above 40%. The court held that the upper limit was imposed only by practical problems, and when that problem later was solved, the invention still could be practiced even though there was more than 40% cyanate in the bath.

This is not the situation here. In this case, the change made by respondents was in the width of the nozzle lip. This was the key to the Narasimhan invention; it was the "operational" part of the invention. The upper limit in the Kolene case was a practical limit because of a sludge problem. The lower limit, a bath that was at least 25% cyanate, was what made the invention work. Nothing in the Kolene case suggests that the defendant's

process would have been found to be infringing if defendant had used less than 25% cyanate, and had found some other way to treat the metal.

In the instant case, the use of the wide nozzle lips was the heart of the invention, since it was only when these lips were used that Dr. Narasimhan was able to cast good quality wide amorphous metal strip. Dr. Narasimhan's use of wide lips was not just the "best mode" known to him, it was the only way he knew to cast wide amorphous metal strip at the time that the application for the invention was filed. Dr. Narasimhan did not invent casting close to the chill wheel surface; he invented a way to cast wide amorphous metal strip without spattering. Subsequent advances have shown that his invention is no longer necessary to enable casting of wide amorphous metal strip. The new methods used were not invented by Dr. Narasimhan, and his patent should not extend so far as to cover completely new processes that do not use his invention. The change from wide to narrow nozzle lips was not an unimportant variation; it discarded the invention. The use of wide lips is the most important feature in the summary of the invention in the '257 patent itself, and it is clearly separated from the description of the various modes of practicing the invention that forms a separate section of the patent specification. To give Dr. Narasimhan patent protection for all subsequent processes involving close to the surface casting of amorphous metal would be to say that everything relating to this kind of casting requires the use of his invention. This is not true.

In Hughes Aircraft Co. v. U.S., 717 F.2d 1362, 219 U.S.P.Q. 473 (Fed. Cir. 1983), the court held that a defendant using a variation in technique made possible by new technology could not escape "the web of infringement." (219 U.S.P.Q. at 483.)

In the instant case, it is not a question of the same process being used with the benefit of advanced technology. Here, the respondents have given up the very thing that made the Narasimhan invention work: the wide lips on the nozzle. One cannot find that narrow nozzle lips, which do not prevent spattering if the other casting elements are not precisely right, are the equivalent of wide lips, which offer that protection.

Finally, in American Hospital Supply Corp. v. Travenol Laboratories, Inc., 223 U.S.P.Q. 577 (Fed. Cir. 1984), the court cited Hughes Aircraft with approval, and stated that an "appropriate range of equivalents may extend to post-invention advances in the art in an appropriate case." (223 U.S.P.Q. at 583.)

This is the most difficult of the three cases. In American Hospital, the inventor set forth in his patent a formula for nineteen ingredients in interrelated molar ranges, a formula that unexpectedly was of enormous benefit to certain patients with advanced liver disease. Under conventional medical treatment at the time of the invention, many of the ingredients in the formula were considered to be harmful to such patients. The defendant copied the high ratio of branched chain amino acids to aromatic amino acids from complainant's patent, but the molar ranges for five amino acids in respondent's formula fell below the claimed molar ranges. The court stated, in effect, that the patent claims could cover the substitution of equivalent ingredients or the same ingredients in different ranges under the doctrine of equivalents even though the changes were discovered to be the equivalent of the original formula only as the result of research that took place after the patent issued. The court then found that complainant had not met its burden of proving infringement under the doctrine of equivalents because the record showed that the mechanism

of hepatic encephalopathy was unknown. The court therefore could not decide whether the new formula and the claimed formula functioned in substantially the same way. The court did not know why either formula worked.

The staff argues that the substitution of equivalents based on knowledge learned in later research can be covered by a patent under the doctrine of equivalents in certain circumstances. There is no dispute on this as a matter of law in an appropriate case, assuming that the alleged "equivalent" that is substituted for an element in the claimed invention is not in fact a completely different invention.

In the American Hospital case, the principal idea of the inventor, that a formula rejected by current medical opinion could help a particular group of patients, was copied by the defendant from the inventor. This idea, the important break-through of the inventor's work, could not be patented without the formula, but it was nonetheless original and valuable. An effort to find infringement under the doctrine of equivalents as an equitable doctrine based on fairness was warranted in that case.

In the present case the respondents are not using the novel idea contributed by Dr. Narasimhan, the wide nozzle lips that allowed wide amorphous metal strip to be cast without spattering. The substitution of narrow nozzle lips for wide nozzle lips is not the substitution of an "equivalent" under the doctrine of equivalents. The wide lips and the narrow lips do not perform substantially the same function in substantially the same way, although they obtain the same result, at least in the new processes used by Hitachi and Vacuumschmelze.

Allied relies primarily on Thomas & Betts Corp. v. Litton Systems, Inc., 720 F.2d 1572 (Fed. Cir. 1983) to support its argument that narrow lips are

covered by the '257 patent under the doctrine of equivalents. In that case, the court held that the test of equivalency extends beyond what is literally stated in a patentee's specification to be equivalent and encompasses any element which one of ordinary skill in the art would perceive as interchangeable with the claimed element. 720 F.2d at 1579.

The question is what must be "interchangeable" with the claimed element. Allied suggests that the melt support given by narrow lips is interchangeable with the melt support given by wide lips. But it is the wide lips that are the key to the invention. It is the wide lips that Dr. Narasimhan claimed as making melt support possible. If Allied is able to prove that melt support is provided by wide or narrow lips equally well, it has denied that the Narasimhan invention has any value, and traded places with the respondents in the original proceeding. It is not the melt support that must be interchangeable under the doctrine of equivalents. It is the narrow lips that must be found to be interchangeable with wide lips. The record does not show that narrow lips are interchangeable with or the equivalent of wide lips. It shows that under the circumstances under which Dr. Narasimhan worked, he was able to cast good quality wide strip because he used wide nozzle lips, when no one else was able to cast good quality wide amorphous metal strip. Now that others are able to cast wide amorphous metal strip without using wide lips, it does not logically follow that they are using the equivalent of wide lips. To the contrary, they have found a way to control the other casting factors so that wide lips are no longer necessary.

The doctrine of equivalents cannot be used to expand the patent claim back to its original scope, where the claim was so broad that it was invalid. It cannot be used to incorporate what was known in the prior art into the patent.

The doctrine of equivalents could be used to expand the patent claim to cover the "equivalent" of wide lips, if it could be proved that at some precise point the lips are wide enough so that the Narasimhan invention is used. The evidence in this case, however, will not support such a fine distinction.

The doctrine of equivalents should offer real protection for the Narasimhan invention, but it should not offer protection for a new process that is not the equivalent of the Narasimhan invention, and works for entirely different reasons.

For the respondents who litigated the infringement issue here, a finding will be made that their new processes do not infringe under the doctrine of equivalents. For other new processes, it may be necessary for this issue to be litigated if there is a dispute as to whether the imported product infringes. The Supreme Court in Graver Tank stated that a finding of equivalence is a determination of fact, and a factual determination based on the precise manufacturing process used may have to be made.

The order should not state the legal conclusion that claim 1 covers a new process when the process performs substantially the same function in substantially the same way to obtain substantially the same result as the Narasimhan invention. Such an order would be unconstitutionally vague, and would offer no guidance to one trying to comply.

6. Can the Hitachi respondents now manufacture amorphous metal strip by a casting process that has been modified to avoid infringement of the '257 patent?

The evidence clearly shows that Hitachi now is able to make wide amorphous metal strip of good quality in commercial quantities while using a nozzle with lips narrow enough to fall outside of the scope of the '257 patent. (Hitachi also still can make amorphous metal strip by a process that infringes the '257 patent.)

Since [C] Hitachi had been experimenting with a nozzle having narrow lips. [C]

No significant changes were made in the Hitachi process except in the shape of the nozzle lips. (TR 437-438.) Hitachi describes its new nozzle as [C] . It states that it is [C]

Inside the nozzle is a [C] slot through which the molten metal flows down onto the chilled surface of the casting wheel. [C] .

The record in this case originally did not show [C]

in complainant's or any respondent's process. There was testimony

on the subject by the expert witnesses, but until the recent hearing, no photographs or films showing the [C] were offered into evidence. The recent evidence shows that under certain conditions in the Hitachi process [C]

Photographs of the Hitachi process show that there is always a [C]

. Hitachi claims that its new process using narrower lips than required in the '257 patent improves the surface of the ribbon. The narrow lips used in the new Hitachi process were in the prior art. Narrow nozzle lips were used by Dr. Narasimhan and others casting or trying to cast crystalline and amorphous metal before Dr. Narasimhan had the idea of using wider lips on the nozzle. After extensive experimentation, Hitachi is now able to make [C]

[C]

Three demonstration runs of the new Hitachi process were conducted in September, 1985, during Allied's facility inspection at Hitachi. Runs 900 and 902 were conducted under commercial conditions. (TR 653-654.) Dr. Grant measured the slot and lip widths of the nozzles used in these two runs. [C]

Hitachi therefore has the capability of making good quality wide amorphous metal strip in commercial quantities using narrow nozzle lips that are not covered by the '257 patent.

The record does not show whether it is economically feasible for Hitachi to use the narrow nozzle lips to make commercial quantities of amorphous metal strip, but even if it were [C]

, Hitachi has the capability of making wide amorphous metal strip in commercial quantities.

[C]

[C]

Allied points out that before the hearing commenced, Hitachi misrepresented the [C]

, Hitachi's assertion that the nozzle lips were never wider than the width of the [C] should not be accepted as true.

Some of the factual evidence offered by Hitachi lacked credibility, although this is not true of the expert testimony offered by Hitachi. This raises the question of how much weight should be given to other factual evidence offered by Hitachi. The conclusion that Hitachi is capable of making wide amorphous metal strip by a process that does not infringe the '257 patent is therefore based solely on evidence verified by Allied representatives at the inspection of the Hitachi factory in Japan. The question of whether more than a certification that this process is being used must be required before Hitachi's wide amorphous metal strip is allowed to be imported into this country is discussed in the recommended determination that relates to the proposed modification of the Commission's order.

It is clear that Hitachi has the capability of making good quality wide amorphous ribbon using nozzle lips that are [C] narrower than the width of the [C] . Nozzle lips as narrow as this do not fall within the scope of the '257 patent, even if the scope of the patent is expanded to take into consideration the word "about," and to take into consideration the doctrine of equivalents.

Hitachi can make wide amorphous metal strip using or not using the '257 patent process. How to determine whether a specific shipment was made by an

infringing process is discussed in the recommended determination relating to the exclusion order.

7. Are the Vacuumschmelze respondents now manufacturing amorphous metal strip by a casting process that has been modified to avoid infringement of the '257 patent?

The Vacuumschmelze respondents now are capable of casting good quality wide amorphous metal strip in commercial quantities using a [C] nozzle that has a front nozzle lip that is less than 1 and 1/2 times the width of the nozzle opening. These [C] nozzles are machined [C] while still providing enough structural support so that the nozzle will not break. The material used to make the nozzle is typical of material necessary to withstand the intense heat necessary to cast molten metal.

Vacuumschmelze has [C] casting machines for casting crystalline or amorphous metal, Machines [C]. Machines [C] usually used to cast wide amorphous metal. [C]

On [C] Machines [C], Vacuumschmelze now uses only [C] nozzles. Dr. Hilzinger instructs the Vacuumschmelze workers to grind the nozzle lips to at least [C]. Many nozzle have lips as narrow as [C]. (TR 153.)

Vacuumschmelze takes the position that a better quality product is produced if the melt does not extend out under the nozzle lips. (TR 180-181.)

After the nozzle has been ground and has been put in place next to the wheel, minor adjustments can be made by rubbing the nozzle lips with emory paper to make a variation in the size of the gap of about [C] micrometers. (TR 155.)

After a casting run is completed, the workers regularly look at the nozzles, and Dr. Hilzinger himself inspects some of the nozzles after the runs. (TR 159.)

The nozzle of Machine [C] is ground before each run. The nozzle for machine [C] may be used for more than one run without regrinding. (TR 162.)

Dr. Hilzinger has instructed the workers that the nozzle lips should be ground to a size that is at least as narrow as half of the width of the nozzle opening. (TR 163.) Dr. Hilzinger has confirmed in some instances that on machine [C] the nozzle lips are narrower than 1/2 of the width of the nozzle opening. (TR 163.)

Dr. Hilzinger usually determines that the nozzle lip is narrower than 1/2 of the width of the nozzle opening by looking at it with the naked eye. (TR 163.) These observation were confirmed by measurement by instruments on some of the nozzles. (TR 167.) The widths of the nozzle lips on machines [C] have not been recorded in the past, (TR 167), but the dimensions of the nozzle opening have been recorded. (TR 167.) In the Vacuumschmelze process, the shape or geometry or thickness of the ribbon is determined by the dimensions of the nozzle opening. (TR 168.)

After the experimental period with machine [C] was completed, the nozzles of the [C] machine have been almost as narrow as half the width of the nozzle opening, and at least narrower than the width of the nozzle opening. (TR 164.)

Vacuumschmelze at this time is using the [C] nozzles in all of its production of amorphous metal. Dr. Hilzinger testified that his company has no reason to want to use nozzles with wider lips, and he did not want melt extending under the entire width of the nozzle lips. Vacuumschmelze concedes that its new process has a minute amount of melt extending under each nozzle lip between the nozzle lip and the wheel surface, and to this extent it constrains or supports the melt between the nozzle lip and the wheel surface. It argues that to the extent that Vacuumschmelze supports the melt, the prior art also supported the melt, and that this tiny amount of melt extending out under the nozzle lips as the melt comes out and turns the corner of the nozzle was not considered by Allied to be "melt support" in the prior art. Allied tried to show that Vacuumschmelze's photographs of its process were flawed, and that there was much more melt under the nozzle lips. Regardless of how much melt extended under the nozzle lips, it is found that there was some melt support in the new Vacuumchmelze process, but that the nozzle lips were so narrow that the maximum amount of melt support possible using those lips would be less than that contemplated in the Narasimhan invention. The nozzle lips are in any event too narrow to fall within the scope of the Narasimhan invention.

Allied argues that Vacuumschmelze's nozzle openings are getting wider, and that they are frequently [C] wide. Allied suggests that the reason for this is that Vacuumschmelze wants to have wider lips, so that it can use melt support, but realizes that its lips must be less wide than the nozzle

opening. Vacuumschmelze replies that the thickness of the strip desired determines the width of the nozzle opening, although a change in wheel speed could be used to control the thickness of the strip. Nozzle openings greater than about one millimeter in width fall outside of the scope of claim 1, because the summary of the invention in the patent specification states that the slot must have a width of about 0.3 to about 1 millimeter. The question of whether this width can be expanded to 2 millimeters and wider, and still be covered by the patent under the doctrine of equivalents, is not reached in this case because both respondents use nozzle lips that fall outside the scope of the patent under the doctrine of equivalents. Moreover, the record does not show that Vacuumschmelze wants or needs to use extensive melt support in its new process, or that it wants to use wider lips to get this melt support.

Vacuumschmelze now can make commercial quantities of good quality wide amorphous metal strip [C] , , using nozzles with lips that are significantly more narrow than the width of the nozzle opening. Nozzle lips as narrow as this are outside of the scope of the '257 patent process, even under the doctrine of equivalents.

8. Conclusions

After consideration of the evidentiary record and the arguments of the parties, it is found that both the Vacuumschmelze and Hitachi respondents now have the capability of manufacturing good quality wide amorphous metal strip in commercial quantities by a casting processes that have been modified to avoid infringement of the '257 patent if either process were used in the United States.

The evidentiary record in this proceeding consists of all exhibits identified in the following exhibit lists of the parties: Allied Exhibit 1000, Staff Exhibit 200, Hitachi Exhibit HM-1000, Vacuumschmelze Exhibit V-17, and Nippon Steel Corporation Exhibit NSC Ex. 1, and the transcript of the testimony at the hearing. Staff Exhibit 112, which was accepted into evidence at the hearing, is also part of the evidentiary record. The pleadings record includes all papers and requests properly filed with the Secretary in this proceeding. 1/

Janet D. Saxon

Janet D. Saxon
Administrative Law Judge

Issued: March 3, 1986

1/ Pursuant to 19 C.F.R. § 210.53(h), this initial determination shall become the determination of the Commission unless a party files a petition for review of the initial determination pursuant to § 210.54, or the Commission pursuant to § 210.55 orders on its own a review of the initial determination or certain issues therein. For computation of time in which to file a petition for review, refer to §§ 210.54, 201.14, and 201.16(d).

CERTIFICATE OF SERVICE

I, Kenneth R. Mason, hereby certify that the attached Public Version Initial Advisory Opinion and Findings of Fact and Conclusions of Law were served by hand upon Stephen Sulzer, and upon the following parties via first class mail, and air mail where necessary, on March 19, 1986.

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CERTAIN AMORPHOUS METAL ALLOYS AND
AMORPHOUS METAL ARTICLES

Inv. No. 337-TA-143

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[PUBLIC VERSION #2]

U.S. INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In the Matter of	)	
	)	
CERTAIN AMORPHOUS METAL ALLOYS AND AMORPHOUS METAL ARTICLES	)	Investigation No. 337-TA-143
	)	
	)	
	)	

FINDINGS OF FACT AND CONCLUSIONS OF LAW

I. The '257 Patent

1. United States Letters Patent No. 4,221,257 relates to a casting method for making continuous amorphous metal strip from melt. (Ex. P-258, Col. 3, lines 18-24.)

2. Claim 1 of the '257 patent claims:

> 1. A method of forming continuous strip of amorphous metal from a molten alloy capable of forming an amorphous structure comprising:
>
> a. forcing the molten alloy under pressure through a slotted nozzle positioned generally perpendicular to the direction of movement of a chill surface and located in close proximity to the chill surface to provide a gap of from about 0.03 to about 1 millimeter between said nozzle and the chill surface;
>
> b. advancing the chill surface, at a predetermined speed; and
>
> c. quenching the molten metal in contact with the chill surface at a rapid rate to effect solidification into a continuous amorphous metal strip.

3. The dimensions of the "slotted nozzle" referred to in claim 1 are not set forth expressly in claim 1.

4. If claim 1 were read literally, it would be so broad in scope that it would be invalid under Section 103 of the Patent Act.

5. The word "nozzle" in claim 1 is ambiguous, and it can be construed in the context of the patent specification. The word "nozzle" in claim 1 is construed in the context of the part of the patent specification describing the summary of the invention. The dimensions of the width of the nozzle opening and the relationship of that width to the width of each nozzle lip as described in the patent specification are read into claim 1 as limitations.

6. Claim 1 as so construed is not invalid under Section 103 of the Patent Act.

7. In the '257 patent specification, the nozzle opening or slot is described as defined by a pair of generally parallel lips, a first lip (or back lip) and a second lip (or front lip) numbered in the direction of movement of the chill surface. (Ex. P-258, Col. 3, lines 37-40.)

8. In the '257 patent specification, the nozzle opening or slot must have a width, measured in the direction of movement of the chill surface, of from "about" 0.3 to "about" 1 mm. (Ex. P-258, Col. 3, lines 40-42.)

9. In the '257 patent specification, the dimensions of the width of the lips of the nozzle are described as "critical."

10. In the '257 patent specification, the first lip (or back lip) is described as having a width at least equal to the width of the slot.

11. In the '257 patent specification, the second lip (or front lip) is described as having a width of from "about" 1.5 to "about" three times the width of the slot. (Ex. P-258, Col. 3, lines 52-53.)

12. All other claims in the '257 patent are dependent upon claim 1.

13. Although the patent specification refers to supporting the melt, claim 1 does not expressly refer to "supporting the melt." No ambiguous word or phrase in claim 1 can be construed by reference to the patent specification as including a limitation of "supporting the melt" as part of claim 1. Claim 1 cannot be construed as including a limitation of "supporting the melt".

14. Under the doctrine of equivalents, it may be possible under certain circumstances to expand claim 1 to include a process that uses the Narasimhan invention, as long as the process was not already in the public domain.

15. The Narasimhan invention that is the subject of the '257 patent is a process for casting amorphous metal strip in which a nozzle with relatively wide lips (lips that are of a certain minimum width relative to the width of the nozzle opening) is brought down close to a rapidly moving chill wheel surface, and the melt is pushed out of the nozzle opening where it is then supported between the bottom of a wide nozzle lip and the wheel surface or between the bottom of a wide nozzle lip and the solidification front, allowing wide amorphous metal strip to be cast without the melt puddle becoming unstable and the melt spattering.

16. A novel part of the process was the use of the wide lips that enabled Dr. Narasimhan to cast wide amorphous strip without the melt spattering.

17. [C]

18. [C]

[C]

II. The Vacuumschmelze Process

19. Dr. Rainer Hilzinger is responsible at Vacuumschmelze for the production of amorphous materials. (TR 141.)

20. Vacuumschmelze has [C] casting machines in its facility, [C] (TR 141.) Machines [C] are used for production of amorphous metal products. (TR 142.)

21. Slotted nozzles are used for the purpose of casting amorphous metals on [C] machines [C] . (TR 143.)

22. [C] machines [C] now use only [C] nozzles. (TR 143.)

23. Vacuumschmelze Physical Exhibits VC and VD were used in the casting runs which were demonstrated for Allied's counsel at the facility inspection at Vacuumschmelze in Hanau, West Germany, in October 1985. (TR 149.)

24. Two such runs were made for Allied representatives, and both runs were successful. (TR 149.)

25. Both nozzles had lips that were less wide than the nozzle opening.

26. Every nozzle is ground by personnel in Dr. Hilzinger's laboratory to its final [C] . (TR 151-152.)

27. Three people in Dr. Hilzinger's laboratory grind the [C] machine nozzles. They are instructed by Dr. Hilzinger to grind the nozzle to a [C] so that the lips are [C] and still maintain the mechanical stability of the lip. (TR 152.)

28. Dr. Hilzinger advises his workers to make the nozzle lips at least [C] , and they can grind the nozzle lips [C] . (TR 153.)

29. If the nozzle lips are ground more [C] than that, the material breaks away. (TR 153.)

30. Vacuumschmelze does not grind the lips of the nozzle after the [C] has been made.

31. Dr. Hilzinger sometimes looks at the nozzles for [C] machines [C] immediately after grinding is finished. He frequently looks at the nozzles after the run is completed. (TR 159.)

32. Dr. Hilzinger looks at about three, four or five nozzles in a week for machine [C] . Between [C] casting runs are made on machine [C] in an ordinary week. (TR 159-160.)

33. Vacuumschmelze has about [C] per day on machine [C] , and Dr. Hilzinger inspects the machine [C] nozzles used in about every other run. (TR 160.)

34. Vacuumschmelze can use its nozzles for several runs. (TR 162.)

35. For machine [C], the grinding of the nozzle is done each time a casting run is made. Once the nozzle is removed from machine [C], the nozzle is ground again to be sure that the nozzle is parallel to the wheel. (TR 162, 163.)

36. Dr. Hilzinger has instructed his workers to grind the nozzle lips to be at least as narrow as half of the width of the nozzle opening. (TR 163.)

37. Dr. Hilzinger has confirmed that his workers have followed his instructions and each nozzle lip is narrower than 1/2 of the width of the nozzle opening. Dr. Hilzinger determines that the lip is narrower than 1/2 of the width of the nozzle opening by looking at it with the naked eye. (TR 163.)

38. After the experimental period had been completed with machine F, the nozzles which Dr. Hilzinger inspected for that machine were almost as narrow as half of the width of the nozzle opening, and at least more narrow than the width of the opening. (TR 164.)

39. Dr. Hilzinger sometimes measured the [C] machine nozzles with an instrument. (TR 166.) The instrument measurements confirmed Dr. Hilzinger's observations with the naked eye as to the lip dimensions. (TR 167.)

40. Dr. Hilzinger did not record his observations or measurements of lip width for the nozzles used on [C] machine [C] . (TR 167.)

41. The width of the nozzle opening used at Vacuumschmelze varies depending upon the thickness of the ribbon to be cast. A typical nozzle opening is from about [C] millimeters. In the Vacuumschmelze process, the nozzle opening is typically wider than 0.3 to 1 millimeter. (TR 203.)

42. The lip dimensions are not important for the functioning of the Vacuumschmelze process. Dr. Hilzinger regularly observed the lip dimensions in order to be sure that Vacuumschmelze was able to cast amorphous ribbon with very narrow nozzle edges. (TR 206.)

43. In the Vacuumschmelze process, there is some melt present during casting on the lower surface of the lip of each nozzle, even though the amount of melt may be small. This melt is found on the bottom of the front nozzle lip where the melt comes out of the nozzle opening and turns the corner at the nozzle lip, moving in the direction in which the chill wheel is turning. A minute amount of melt also is found at the corner of the back nozzle lip. (TR 746, 748-749.)

44. The amount of melt under the lower surface of the lips of the nozzle depends upon other factors, such as the size of the gap between the lips of

the nozzle and the wheel surface, the speed of the wheel, the amount of pressure on the melt, the size of the nozzle opening, and to a lesser extent, the consistency of the melt, and the texture of the surface of the nozzle lips. (Dr. Mehrabian, TR 557-558, 583-588, 596-598, and passim, and Dr. Hilzinger, TR 269-279.)

45. The Vacuumschmelze process supports or constrains the melt between the corner of the front lip of the nozzle and the surface of the chill wheel at the point where the melt comes out of the nozzle opening and turns the corner in the direction of movement of the chill wheel surface.

46. The Vacuumschmelze process supports or constrains the melt between the corner of the back lip of the nozzle and the surface of the wheel.

47. Dr. Mehrabian, Allied's expert witness, was able to look at Vacuumschmelze nozzles VC, VF, VH, and VB and determine with the naked eye that the nozzle lips were narrower than the nozzle opening. (TR 603-606.)

48. Dr. Mehrabian was able to tell with the naked eye that the nozzle lips in Vacuumschmelze Physical Ex. VD were less than 1.5 times the width of the nozzle opening. (TR 605.)

49. Vacuumschmelze is capable of casting good quality wide amorphous metal strip in commercial quantities using nozzle lips that are more narrow than the nozzle opening.

50. Vacuumschmelze now uses a process that does not infringe the '257 patent.

51. The new Vacuumschmelze process is now used regularly for the production of all commercial wide amorphous metal products. If the Commission permits Vacuumschmelze to import into the United States wide amorphous metal products in the future, this process will be used.. (TR 184.)

III. The Hitachi Process

52. Hitachi's motion for amendment of the Commission's Exclusion Order was filed with the ITC on February 22, 1985.

53. One of the papers submitted in support of the motion was an affidavit dated February 15, 1985. (Allied Ex. 705.) Hitachi stated that [C]

54. Hitachi did not tell the Commission that in actual practice [C]

55. Hitachi represented that the dimensions of the lips on its "Narasimhan comparison nozzle" were "the narrowest allowable in the '257 (Narasimhan) process patent specification". (Allied Ex. 705 at 6.) This was not true. (Hitachi Ex. 3 and Ex. 39.)

56. Some of the Hitachi factual evidence lacked credibility. This raises a serious question as to the weight to be given to some of Hitachi's other factual evidence. Rather than reach this question, all findings relied upon herein with respect to Hitachi's ability to make amorphous metal by a

non-infringing process are based upon facts verified by Allied representatives at the inspection of the Hitachi facilities in Japan.

57. After the issuance of the Initial Determination, Hitachi began to use a new nozzle in its process to make wide amorphous metal strip. [C]

58. [C]

59. [C]

60. Hitachi is capable of using a new process that does not infringe claim 1 of the '257 patent because it can make amorphous metal strip [C]

61. The evidence does not establish that this process is [C]

62. The new Hitachi process [C]

63. In the new Hitachi process, [C]

64. Hitachi's engineering specification permits [C]

65. The front lip of Hitachi's modified nozzle sometimes is [C]

66. Hitachi normally uses a gap between the nozzle lips and the wheel surface ranging from [C]

67. The ejection pressure used by Hitachi is [C]

68. Hitachi made a film to prove that its new process was capable of casting good quality wide amorphous metal strip while using nozzle lips that were narrower [C]

69. The nozzle used in the film demonstration had the [C] nozzle lips permitted by Hitachi's engineering specification.

70. [C]

71. In the film showing the casting of amorphous metal strip using this nozzle, Hitachi also showed the casting of strip using a nozzle that it described as the type of nozzle covered by the '257 patent ("the Narasimhan comparison nozzle"). This nozzle was misrepresented. (See Finding No. 55.)

72. In the film showing the new Hitachi nozzle, [C]

73. [C]

74. [C]

75. [C]

76. [C]

77. Production runs 900, 901 and 902, conducted during the Hitachi facility inspection, were made under conditions specified and verified by Allied.

78. In the second run, production run 901, [C]

79. The production run sheets for run 901 show [C]

80. The production run sheets for production runs 900 and 902 show [C]

81. [C]

82. [C]

83. Because [C]

, all three runs used processes that did not literally infringe the '257 patent.

84. Hitachi Runs 900, 901 and 902 used processes that do not infringe the '257 patent under the doctrine of equivalents.

85. Hitachi is capable of making good quality wide amorphous metal strip in commercial quantities using a process that does not infringe the '257 patent because the nozzle lips are more narrow [C]

86. The record does not show that Hitachi has used or will use this process in the future for its products to be imported into the United States.

87. The record does not show that it would be [C]

for Hitachi to use this process for its imports into the United States.

IV. Means of Enforcing an Exclusion Order

88. Both Hitachi and Vacuumschmelze have the capability of making wide amorphous metal strip by a process that does not infringe the '257 patent.

89. There is no procedure known at the present time to any of the parties that would enable Customs to distinguish between an amorphous metal product made by Hitachi or Vacuumschmelze by an infringing process as opposed to a non-infringing process, so that only products infringing the patent could be excluded on the basis of testing alone.

90. The profilometer test proposed by Allied would not distinguish between a process using nozzle lips narrower than those covered by the '257 patent and a process infringing the '257 patent.

91. Under the Allied profilometer test, a product made by a process identical to that described in claim 1 of the '257 patent, with the sole exception that a gap of 1.5 millimeters is used between the nozzle and the chill surface (making the process non-infringing), would be identified as being made by an infringing process. (TR 910-912.)

92. A product made by the process described in the '257 patent, except that the widths of the nozzle lips are more narrow than the width of the [C] , would be identified by the Allied profilometer test as being made by an infringing process. (TR 914.)

93. The new Hitachi and Vacuumschmelze processes do not infringe the '257 patent, but the profilometer test of products made by these processes would show that these processes infringe the patent. (TR 1007.)

94. Even if it were determined that amorphous metal strip failing the profilometer test should be kept out of the United States as made by an

infringing process, Customs would be unable to determine from that test whether certain kinds of wide amorphous metal strip made by different processes were infringing or non-infringing or whether they should be excluded or allowed to be imported.

95. Mr. Crain, Chief of the Technical Section of the Operations Branch of the Technical Services Division of Customs at the Customs Service Headquarters in Washington, D.C., when viewing the profilometer tracings of Nippon Steel Exhibit 15, could not determine from those tracings whether the product should be excluded or allowed to be imported. (TR 1043-53.) The tracings were of amorphous metal strip produced on Allied experimental and commercial casting machines and of one strip produced by Hitachi.

96. Profilometer tracings made on experimental equipment are not necessarily like the tracings of a commercial product. (TR 1072.)

97. The tracings of Nippon Steel Exhibit 15 were made on amorphous metal strips more than 7 millimeters wide. (TR 1078.)

98. It is in the public interest to modify the exclusion order in this case to enable certain products made by a non-infringing process to be imported into the United States, while still excluding infringing products. It is also in the public interest to add an order to cease and desist to the exclusion order.

99. The modified order should read as follows:

EXCLUSION ORDER

IT IS ORDERED THAT:

1. Amorphous metal articles manufactured abroad by a method of forming continuous strip of amorphous metal from a molten alloy capable of forming an amorphous structure comprising:

a. forcing the molten alloy under pressure through a slotted nozzle positioned generally perpendicular to the direction of movement of a chill surface and located in close proximity to the chill surface to provide a gap of from about 0.03 to about 1 millimeter between said nozzle and the chill surface;

b. advancing the chill surface at a predetermined speed; and

c. quenching the molten metal in contact with the chill surface at a rapid rate to effect solidification into a continuous amorphous metal strip; in accordance with a process set forth in claim 1, 2, 3, 5, 8, or 12 of U.S. Letters Patent 4,221,257, be excluded from entry into the United States for the remaining term of said patent except:

(a) as provided in this Order, or

(b) as licensed by the patent owner.

The phrase "slotted nozzle" in claim 1 is construed as meaning that there must be a nozzle with a rectangular or slotted opening, and there must be wide lips on the surface of the nozzle next to this opening. Wide lips mean that the width of the back lip (lip 1), measured in the direction of movement of the chill surface, must have a width at least equal to the width of the slot.

The slot, or nozzle opening, measured in the direction of movement of the chill surface, must have a width of from "about" 0.3 to "about" 1 millimeter. The word "about" is construed as requiring the slot to be between 0.25 and 1.05 millimeters wide.

The width of the front lip (lip 2), measured in the direction of movement of the chill surface, must be from "about 1.5" to "about 3" times the width of the slot. The word "about" is construed as requiring the front lip to have a width of from 1.45 to 3.05 times the width of the slot.

2. Any amorphous metal strip, ribbon or wire having a width of less than seven (7) millimeters shall not fall within the scope of paragraph 1 of this Order and shall not be excluded from entry into the United States pursuant to this Order.

3. Pursuant to 19 U.S.C. § 1337(i), this Order shall not apply to articles 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.

4. Any person, including any respondent in the original proceeding or any other person, desiring to import into the United States amorphous metal covered by this Order shall submit certifications to Customs in accordance with 19 U.S.C. § 1482 and 19 U.S.C. § 1484, certifying:

(a) that the amorphous metal was not made by a process that would infringe the '257 patent if the product were made in the United States, and identify the process by which it was made,

(b) the identity of the manufacturer of the amorphous metal,

(c) whether the manufacturing process includes forcing the molten metal from a slotted nozzle located in close proximity to a chill surface, and if not, what method is used, and if so,

(d) stating the widths of the nozzle slot or nozzle opening and the nozzle lips.

If such certification is otherwise complete, and if it shows that the widths of the nozzle lips are narrower than the dimensions given in paragraph 1 of this Order, or if other dimensions are outside the dimensions given in paragraph 1 of this Order, then the amorphous metal produced by such manufacturing process shall not be excluded from entry into the United States pursuant to this Order.

If such certification is otherwise complete, and if it shows that the process used does not fall within the description of the process found in paragraph 1 (a), (b), or (c) of this Order, and it shows what process was used, then the amorphous metal produced by such manufacturing process shall not be excluded from entry into the United States pursuant to this Order.

5. Copies of all certifications required by paragraph 4 of this Order shall be filed with the Commission pursuant to Rule 201.8 of the Commission's Rules of Practice and Procedure, 19 C.F.R. § 201.8.

6. Any person desiring to import into the United States amorphous metal covered by this Order shall keep records showing the widths of the nozzle opening and the nozzle lips used in each run in which an imported product was made. Failure to keep such records will be deemed to be prima facie evidence that a product was made by a process that infringes the '257 patent in any proceeding brought at the Commission in which the issue of whether a product infringes the '257 patent process or whether importation of a product constitutes an unfair act under Section 337 is raised.

7. If either Allied or the Commission investigative attorney has reason to believe that amorphous metal products have entered the United States pursuant to a false certification under paragraph 4 of this Order, either may, in addition to any other remedy that may be available, request the Commission to institute such further proceedings as may be appropriate to assure compliance with this Order.

8. Any respondent in the original proceeding who proposes to import into the United States, but has not yet imported, amorphous metal covered by this Order and manufactured by a new process (not previously litigated at the Commission) similar to the process set forth in paragraph 1 hereof, but in the opinion of the respondent not infringing the '257 patent, may petition the Commission for an advisory opinion proceeding pursuant to 19 C.F.R. § 211.54(b) in order to determine whether the amorphous metal sought to be imported is within the scope of paragraph 1 of this Order, if this product has not yet been imported into the United States.

9. If such product already has been imported, any respondent may request that the Commission commence a proceeding under the Administrative Procedure Act to determine whether said product was made by a process that is covered by the '257 patent, provided that no such proceeding will be instituted if the Commission commences or has commenced a civil penalty action in district court based on the importation of the same product by this respondent or based on the importation by another of the same product manufactured by this respondent.

10. Any person who was not a respondent in the original proceeding who proposes to import into the United States or has tried to import into the United States but has had the product stopped by Customs, or has imported into the United States successfully because of the certification filed with Customs or because Customs failed to stop the importation, may request that the Commission commence a proceeding under the Administrative Procedure Act to determine whether said product was made by a process that is covered by the the '257 patent, provided that no such proceeding will be instituted if the Commission commences or has commenced a civil penalty action in district court based on the importation by another of the same product manufactured by this person.

IT IS ORDERED THAT:

1. TDK Corporation, TDK Electronics Corporation, MH&W International Corporation, Vacuumschmelze GmbH, Siemens Corporation, Hitachi Metals, Ltd., Hitachi Metals International, Ltd., Nippon Steel Corporation and Nippon Steel, Inc., their successors and assigns, acting through their officers, agents, representatives or employees, directly or through any corporation, subsidiary, division or other device, in connection with the importation of amorphous metal products into the United States or the subsequent sale of such products, do forthwith cease and desist from:

importing into the United States amorphous metal articles, or subsequently selling in the United States imported amorphous metal articles manufactured abroad by a method of forming continuous strip of amorphous metal from a molten alloy capable of forming an amorphous structure comprising:

a. forcing the molten alloy under pressure through a slotted nozzle positioned generally perpendicular to the direction of movement of a chill surface and located in close proximity to the chill surface to provide a gap of from about 0.03 to about 1 millimeter between said nozzle and the chill surface;

b. advancing the chill surface at a predetermined speed; and

c. quenching the molten metal in contact with the chill surface at a rapid rate to effect solidification into a continuous amorphous metal strip; in accordance with a process set forth in claim 1, 2, 3, 5, 8, or 12 of U.S. Letters Patent 4,221,257, for the remaining term of said patent except:

(a) as provided in this Order, or

(b) as licensed by the patent owner.

The phrase "slotted nozzle" in claim 1 is construed as meaning that there must be a nozzle with a rectangular or slotted opening, and there must be wide lips on the surface of the nozzle next to this opening. Wide lips mean that the width of the back lip (lip 1), measured in the direction of movement of the chill surface, must have a width at least equal to the width of the slot.

The slot, or nozzle opening, measured in the direction of movement of the chill surface, must have a width of from "about" 0.3 to "about" 1 millimeter. The word "about" is construed as requiring the slot to be between 0.25 and 1.05 millimeters wide.

The width of the front lip (lip 2), measured in the direction of movement of the chill surface, must be from "about 1.5" to "about 3" times the width of the slot. The word "about" is construed as requiring the front lip to have a width of from 1.45 to 3.05 times the width of the slot.

2. Any amorphous metal strip, ribbon or wire having a width of less than seven (7) millimeters shall not fall within the scope of paragraph 1 of this Order.

3. Pursuant to 19 U.S.C. § 1337(i), this Order shall not apply to articles 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.

4. If any respondent violates this Order To Cease And Desist, the Commission may bring a civil penalty action in a United States district court pursuant to 19 U.S.C. § 1337(f)(2), seeking civil penalties or a mandatory injunction, or both.

5. Each respondent subject to this Order To Cease and Desist who wants to import into the United States amorphous metal covered by this Order shall keep records showing the widths of the nozzle opening and the nozzle lips used in each run in which a product intended for importation into the United States is made. Failure to keep such records will be deemed to be prima facie evidence that a product was made by a process that infringes the '257 patent in any proceeding brought in a United States district court in which the issue of whether a practice violates this Order to Cease and Desist is raised, or at the Commission in which the issue of whether a product is made by a process that infringes the '257 patent or whether importation of a product constitutes an unfair act under Section 337 is raised.

IT IS FURTHER ORDERED THAT:

1. Notice of this Action and Order be published in the Federal Register.

2. A copy of this Action and Order, and of the Commission Opinions in support thereof, be served upon each party of record in this investigation and upon the Department of Health and Human Services, the Department of Justice, the Federal Trade Commission, and the Secretary of the Treasury.

The Commission may amend this Order in accordance with the procedure described in 19 C.F.R. § 211.57 or such other procedures as the Commission may adopt.

BY ORDER OF THE COMMISSION:

Kenneth R. Mason
Secretary

Issued:

(END OF MODIFIED ORDER)

100. To the extent that these findings add to or vary from the original findings in this proceeding, this is a result of the new record made in the reopened proceeding, and the new findings take precedence over the original findings.

Janet D. Saxon

Janet D. Saxon
Administrative Law Judge

Issued: March 3, 1986