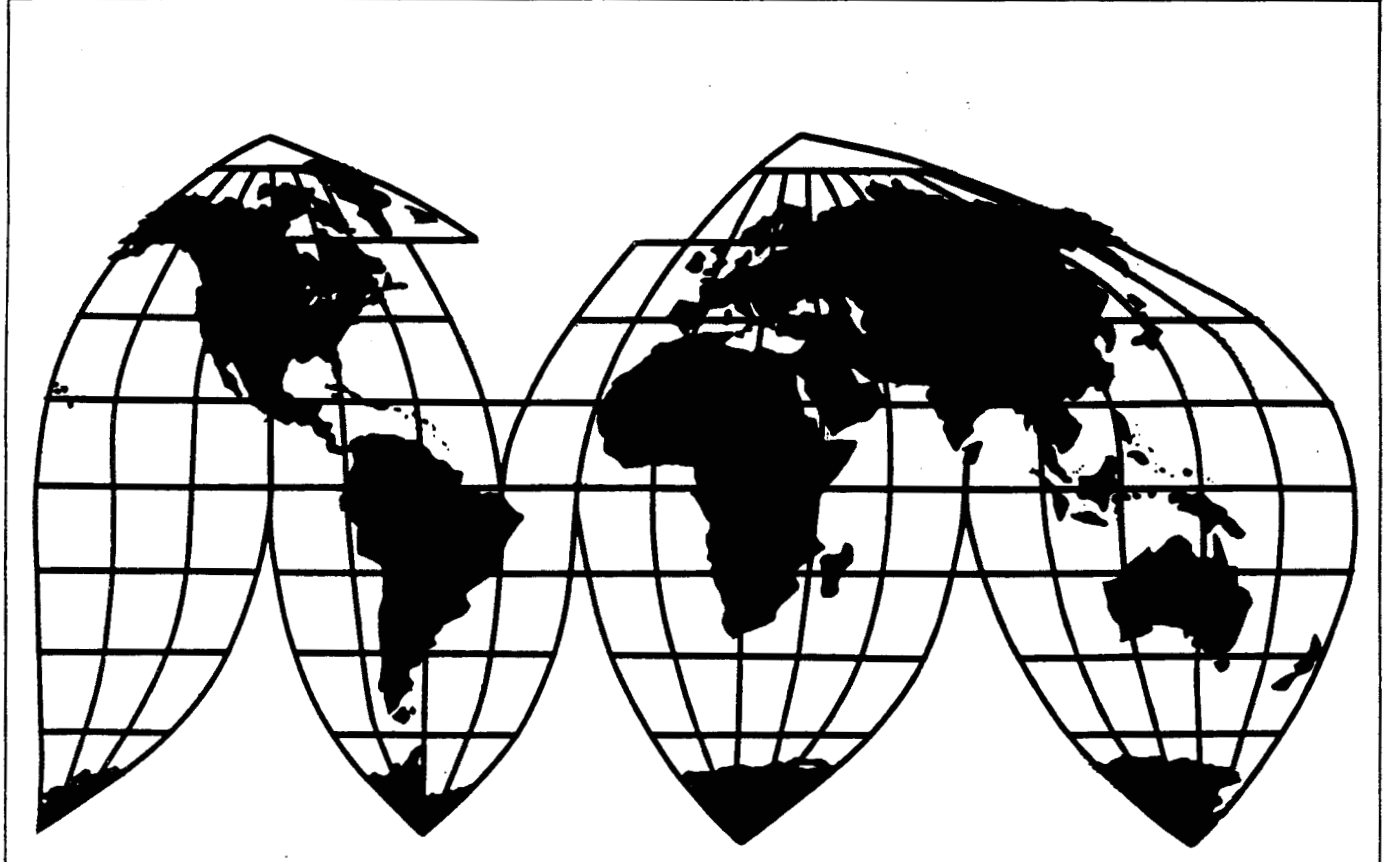
In the Matter of

Certain Condensers, Parts Thereof and Products Containing Same, Including Air Conditioners for Automobiles

Investigation No. 337-TA-334

Publication 2731 **February 1994**

U.S. International Trade Commission



Washington, DC 20436

U.S. International Trade Commission

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COMMISSION OPINION

Introduction

This investigation is before us for final disposition on review of an initial determination (ID) filed by the presiding administrative law judge (ALJ) on April 26, 1993. The ALJ found no violation of section 337 based on her findings that the patent claims at issue were not infringed by the respondents, were not valid because they were anticipated and obvious in view of the prior art, and were unenforceable due to inequitable conduct in their procurement. On review, we have determined to reverse the ALJ on the validity issues of anticipation, enablement of the two-pass condenser, and obviousness. We also reverse the ALJ on the issue of enforceability. We affirm the ALJ on the issues of indefiniteness, and have made the finding, omitted from the ID, that importation of the accused articles has occurred.

By virtue of the Commission's determination not to review the ALJ's claim interpretation or her conclusion that respondents do not infringe the patent claims at issue, the ID's findings and conclusions on those issues became the Commission's final determination. 58 Fed. Reg. 36701-2 (July 8, 1993). By adopting the ALJ's findings and conclusions on those issues, which are dispositive, the Commission also adopted the ID's determination that there has been no violation of section 337 by respondents.

This opinion discusses the Commission's disposition of the issues under review, viz., importation, patent validity (enablement of two-pass condenser, anticipation, obviousness, and indefiniteness), and patent enforceability (inequitable conduct).[1]

Procedural History

On December 12, 1991, complainant Modine Manufacturing Company ("Modine") of Racine, Wisconsin, filed its section 337 complaint alleging unfair methods of competition and unfair acts in the importation and sale of certain condensers, parts thereof, and products containing same which

[1] Although these issues are not dispositive, we reach them in order to avoid any loss of practical value in the patent at issue. Cf., Cardinal Chemical Co. v. Morton International, Inc., 113 S.Ct. 1967, 1978 (1993).

infringed claims 9 and 10 of the '580 patent.[2] On January 23, 1992, the Commission instituted an investigation based on Modine's complaint by notice in the Federal Register. 57 Fed. Reg. 2784-85. The six respondents currently in the investigation are: Showa Aluminum Corporation; Showa Aluminum Corporation of America; Mitsubishi Heavy Industries, Ltd.; Mitsubishi Heavy Industries America, Inc.; Mitsubishi Motors Corporation; and Mitsubishi Motor Sales of America.

On April 14, 1992, the ALJ issued an ID (Order No. 6) ("Summary ID") granting two motions filed by respondents for summary determination of noninfringement. The ALJ based her determination of noninfringement on prosecution history estoppel, which she held precluded complainant Modine from asserting the '580 patent against condensers with tubes having hydraulic diameters as large as those in Showa's imported condensers. On November 18, 1992, the Commission issued a notice of its determination to reverse the Summary ID and to remand the investigation to the ALJ for further proceedings. [3]

On April 26, 1993, the ALJ issued an ID denying relief on the basis that there was no violation of section 337. On May 6, 1993, Modine petitioned for review of all the major issues decided in the ID, viz., claim interpretation, validity, enforceability, and infringement, and filed a motion to reopen the record to receive new evidence relating to the validity of the '580 patent. The Commission investigative attorney (IA) petitioned for review of the issues of validity and enforceability only. On May 13, 1993, the IA filed a response to the Modine's petition for review. May 18, 1993, the Showa respondents responded to both petitions for review and opposed the motion to reopen the record.[4] The IA also opposed the motion to reopen the record on May 18, 1993. On May 28, 1993, the Commission extended the deadline for determining whether to review the ID. 58 Fed. Reg. 31978 (June 7, 1993). On June 25, 1993, the Commission determined to review the issues of validity, enforceability, and importation. 58 Fed. Reg. 36701-2 (July 8, 1993). No further briefing was requested or received from the parties.

Discussion [5]

I. Commission Review

On review, the Commission may affirm, modify, set aside or remand for further proceedings, in whole or in part, the ID of the ALJ and make any findings of fact or conclusions that in its judgment are proper based on the record in the proceeding. 19 C.F.R. § 210.56. [6]

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[2] Complainant originally asserted infringement of claims 6 and 8 of the '580 patent in addition to claims 9 and 10. On January 28, 1993, shortly before the evidentiary hearing, complainant withdrew its assertions of infringement of claims 6 and 8.

[3] 57 Fed. Reg. 55567 (Nov. 25, 1992); See Certain Condensers, Parts Thereof And Products Containing Same, Including Air Conditioners for Automobiles, Views of the Commission (November 25, 1992). The Commission also designated the investigation "more complicated" pursuant to Commission interim rule 210.59(a), 19 C.F.R. § 210.59(a). 57 Fed. Reg. 55567. The "more complicated" designation extended the statutory deadline for the Commission's final determination to July 23, 1993.

[4] The remaining respondents notified the Commission that they joined in the response of the Showa respondents.

[5] The following citations are used in this opinion: the Hearing Transcript is cited as "[Witness] Tr. at __"; Modine Documentary Exhibits are cited as "Modine Doc. Exh. ___"; Modine Physical Exhibits are cited as "Modine Phys. Exh. __"; Showa Documentary Exhibits are cited as "Showa Doc. Exh. __"; Showa Physical Exhibits are cited as "Showa Phys. Exh. ___."

[6] See also, Certain Acid-Washed Denim Garments and Accessories, Inv. No. 337-TA-324, Commission Opinion at 4-5 (U.S.I.T.C. Pub. No. 2576, Nov. 1992).

II. Importation

Based on the undisputed evidence of record, we determine that all respondents have either manufactured for importation, imported, or sold the accused condensers. Ample evidence, including stipulations, was presented at the evidentiary hearing to establish importation, with respondents proffering no evidence to the contrary. [7]

III. The '580 Patent and the Claims at Issue. [8]

The '580 patent, entitled "Condenser with Small Hydraulic Diameter Flow Path," issued on March 12, 1991, to Modine as the assignee of the inventors, and will expire on that date in 2008. The '580 patent resulted from a series of three applications. The first application, known as the "grandparent application" was filed on October 2, 1985, and subsequently abandoned. The second application, known as the "parent application," was filed on September 5, 1986, as a continuation-in-part (CIP) of the grandparent application. The parent application was also abandoned. The final application, known as the "child application," was filed on January 7, 1988, as a CIP of the parent application, and eventually issued as the '580 patent.

Only claims 9 and 10 of the '580 patent were asserted here.[9] They claim a condenser comprised of a pair of spaced headers having a plurality of tubes extending in hydraulic parallel between the headers. Within each tube are several hydraulically parallel, fluid flow paths. The hydraulic diameter of each fluid flow path is small, with a range of about 0.015 to 0.040 inches.[10] Each fluid flow path has at least one elongated crevice extending along its length. The crevice accumulates the condensate as it condenses from the vaporous refrigerant.

IV. Validity

A. Anticipation and Enablement of a Two-Pass Condenser [11]

The ALJ's finding of anticipation under 35 U.S.C. § 102(b) is dependent upon a determination of whether claims 9 and 10, which claim a "two pass" condenser, were enabled under 35 U.S.C. § 112, first paragraph, in the parent application.[12] Respondents contended that the claims

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[7] See e.g., Mod. Doc. Exh. 54-A at Stip. Nos. 21, 23, 24; Mod. Doc. Exh. 8. Although Mitsubishi Motors Corporation (MMC) refused to stipulate to importation of accused Showa condensers, the record reflects that MMC has in fact engaged in the importation or the sale for importation of accused Showa condensers, particularly Condenser Model No. MS609529 for the Mitsubishi 3000GT automobile. See Modine Doc. Exh. 20-D (MMC Responses to Staff Interrogatory Nos. 4, 5(h), and 6). Moreover, in its response to the complaint, MMC admitted that it installs air conditioning systems containing Showa SC condensers into automobiles, and that such automobiles are imported into the United States by Mitsubishi Motor Sales of America. Showa Phys. Exh K (MMC Response to Complaint at ¶ 5-7, 25, and 27).

[8] Pages 6-7 of the ID contain a discussion of the product at issue.

[9] Claims 9 and 10 are set forth in the APPENDIX to this Opinion.

[10] "Hydraulic diameter" is defined in the specification of the '580 patent as "the cross-sectional area of each of the flow paths multiplied by four and in turn divided by the wetted perimeter of the corresponding flow path". Modine Doc. Exh. 3 ('580 patent, col. 4, lines 50-54).

[11] We affirm the ID's findings and conclusions concerning the crevice element and the hydraulic diameter element, which are found in the ID at pages 27-33.

[12] 35 U.S.C. § 102 provides that a person shall be entitled to a patent unless:

(continued...)

were not enabled by the parent application and that, therefore, the earliest filing date that Modine could establish for claims 9 and 10 was the filing date of the child application, i.e., January 7, 1988. Since Modine admitted selling its parallel flow (PF) condensers more than one year prior to that date, Showa Phys. Ex. BB at 2, respondents argued that claims 9 and 10 were anticipated by Modine's own sales. Modine contended that the claims were enabled by both the grandparent and the parent applications, which were filed on October 2, 1985, and September 5, 1986, respectively, and thus were not anticipated by its own sales.

In a parallel flow condenser, a pass is the distance travelled by the fluid going from one header to the other, regardless of whether there is an outlet in the second header. In a one-pass parallel flow condenser, each flow path has an inlet in one header and an outlet in the opposite header after a single pass. In a two-pass condenser, a flow path has an inlet in the first header, the flow path reverses direction after the first pass, and returns to the first header where there is an outlet. The ALJ found that the following elements of independent claim 9 allow the inlet and the outlet of the condenser to be in either the same header or in an opposing header, an arrangement which is consistent with a "two-pass" condenser:

> a pair of spaced, generally parallel, elongated cylindrical tubes defining headers;
>
> a vapor inlet in one of said tubes;
>
> a condensate outlet from one of said tubes;

Prosecution claim 25, in which the underlined elements first appeared, was added by amendment during prosecution of the child application. Showa Doc. Exh. 5 (Child Application at 414-415). Although prosecution claim 25 was later rejected by the patent examiner, prosecution claims 27 and 28, which depended from claim 25, were allowed and eventually issued as independent claim 9 and dependent claim 10. Showa Doc. Exh. 5 (Child Application at 458-59, 472, 483). The child application also added the following language to the specification: "In some cases, the inlet and outlet may be in the same header and separated by a suitable baffle or plug." Showa Doc. Exh. 5 (Child Application at 243). The "baffle or plug" feature is characteristic of multi-pass condensers.

The ALJ found that "the record does not support a finding that [the parent application description] disclosed to one with ordinary skill in the art that the invention included two-pass condensers with the inlet and outlet in the same header," ID at 34, and concluded that "[t]he concept of a two-pass condenser as part of the invention was new matter not previously described or inherently disclosed" before the filing date of the child application. ID at 35. In reaching this conclusion, the ALJ relied principally upon an argument made by the applicants during prosecution of the parent application to distinguish a prior art patent, the Oohara patent. Applicants distinguished

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[12] (...continued)
(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States . . . .

35 U.S.C. § 112, first paragraph, states:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Oohara on the basis that "Oohara's device is principally a multipass evaporator whereas the applicants' invention is a single-pass condenser." Showa Doc. Exh. 4 (parent application at 161). As a result of her determination that claims 9 and 10 were not entitled to the earlier filing date of the parent application, the ALJ concluded that the "on-sale bar" of 35 U.S.C. § 102(b) rendered claims 9 and 10 invalid as anticipated. ID at 36.

While Modine acknowledged that the parent application did not disclose a two-pass condenser in so many words, it contended that the application did disclose a condenser in a manner that would be understood by one ordinarily skilled in the art. Modine pointed to curve B of Figure 3 of the parent application which was described in the specification of the parent application as applying to a condenser core of the invention where "the length of the flow path in each tube was doubled, i.e., the number of tubes was halved and the tube length was doubled," Showa Ex. 4 (parent application) at 121-122. Modine argued that this statement, together with curve B, inherently disclosed a two-pass condenser in the parent application. The ALJ rejected this argument, even though it acknowledged that the description in the parent application would be consistent with a two-pass condenser. ID at 34.

A patent is presumed valid, 35 U.S.C. § 282, and the burden of proving invalidity is on the party challenging the patent. Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367 (Fed. Cir. 1986) This burden must be met by clear and convincing evidence and never shifts from the challenger. American Hoist and Derrick Co. v. Sowa & Sons, Inc., 725 F.2d 1350 (Fed. Cir. 1984). We find that the ALJ's statement that the parent application's "description [i.e., halving and doubling] would be consistent with a two-pass condenser, but [that] the record does not support a finding that this disclosed to one with ordinary skill in the art that the invention included two-pass condensers with the inlet and outlet in the same header," ID at 34, demonstrates an improper shifting of the burden to Modine to defend the patent's validity.

The Commission has specifically held that a party trying to rebut the presumption of validity on the basis that claims are not enabled by the specification must marshal clear and convincing evidence in favor of its position. Certain Acid-Washed Denim Garments and Accessories, Inv. No. 337-TA-324, Opinion of the Commission, at 6 (1992) (citations omitted). In Acid-Washed Denim, the Commission stated:

> The standard for satisfaction of the written description requirement [of 35 U.S.C. § 112, par. 1] is whether the applicant has "convey[ed] with reasonable clarity to those skilled in the art that, as of the filing date sought, he or she was in possession of the invention. The invention is, for purposes of the "written description" inquiry, whatever is now claimed.

Id. at 9 (emphasis in original); citing Vas-Cath Inc. v. Mahurkar, 935 F.2d 155, 1563-64 (Fed. Cir. 1991).[13]

The application need not describe the invention in the exact words found in the claim at issue; rather, it is sufficient if disclosure of the invention would be "inherent" to one skilled in the art. Application of Lukach, 442 F.2d 967, 969 (CCPA 1971).

Curve B of Figure 3 of the parent application (the predecessor of Figure 5 of the '580 patent) was described as showing the performance of a condenser core where "the length of the flow path in each tube was doubled, i.e., the number of tubes was halved and tube length was doubled." Showa Doc. Exh. 4 (Parent Application at 121-22). In addition, Modine provided testimonial evidence that

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[13] See also In re Gosteli, 10 USPQ2d 1614, 1618 (Fed. Cir. 1989) ("Although [the applicant] does not have to describe exactly the subject matter claimed, . . . the description must clearly allow persons of ordinary skill in the art to recognize that [he or she] invented what is claimed").

the language in the parent application regarding halving the number of tubes and doubling their length implied a two-pass or multi-pass condenser core to one of ordinary skill in the art. This evidence was corroborated by the handwritten draft of Figure 5, which was sent by Modine to the prosecuting patent attorney before the filing of the grandparent application. The handwritten draft identified "curve B" as depicting the results for a "2 pass core." [14]

The only evidence relied upon by the ALJ to support her conclusion that two-pass condensers were not adequately described in the parent application is the applicants' statement during prosecution that "Oohara's device is principally a multipass evaporator whereas the applicants' invention is a single-pass condenser." ID at 34-35. However, that statement was made during prosecution of the parent application to distinguish from the prior art claims that were directed only to single pass condensers. We do not find the statement inconsistent with an interpretation that the parent specification disclosed a two-pass condenser.

Although complainant was under no obligation to come forward with evidence supporting validity, Orthokinetics, Inc. v. Safety Travel Chairs, Inc., 806 F.2d 1565, 1570 (Fed. Cir. 1986), it did submit evidence in the form of testimony of its expert witnesses, Mr. Saperstein and Mr. Guntley.[15] This testimony, which supports a finding that the parent application disclosed a two-pass condenser, is the only evidence of record on the issue of what one of ordinary skill in the art would understand from the parent application. This evidence was not successfully rebutted by respondents.

We conclude that respondents did not come forward with clear and convincing evidence that the parent application failed to disclose adequately the two-pass condenser to one of ordinary skill in the art. We find that the language added in the child application was only a clarification of a disclosure that was already present and did not constitute new matter. When Modine added claim 25 to the child application, it explained that amendment of the claim to add language including inlets and outlets in the same header was intended "to make it clear that the invention is not restricted to a condenser wherein one of the headers contains a vapor inlet and the other one contains a condensate outlet." Showa Doc. Exh. 5 (Child Application at 416).

Accordingly, we find that respondents have not carried their burden of proving the claims at issue invalid by clear and convincing evidence, and we reverse the ALJ's finding that the asserted claims are invalid as anticipated under 35 U.S.C. § 102(b).

B. Invalidity Under 35 U.S.C. § 103 -- Obviousness

The leading decision on obviousness is that of the Supreme Court in Graham v. John Deere Co., 383 US 1, 17-18 (1966), which sets out four factors to be considered when making a determination on obviousness: (1) the scope and content of the prior art; (2) the differences between the prior art and the claimed invention; (3) the level of ordinary skill in the pertinent art; and (4) objective evidence on nonobviousness (the so-called "secondary considerations"). Moreover, under Federal Circuit precedent, a finding that claims are obvious over the prior art requires a showing that there is some teaching, or suggestion in the prior art to make the combination that is recited in the claims. See, e.g., Smithkline Diagnostics, Inc. v. Helena Laboratories Corp., 859 F.2d 878, 887 (Fed. Cir. 1988).

The ALJ determined that all of the elements of claims 9 and 10 are found in the prior art, but that no single prior art reference contains all the elements of claims 9 and 10. ID at 49. The ALJ found that a condenser made by Modine, called the "Cat condenser," is the closest prior art to the claimed invention, lacking only the following elements of the claimed invention: (1) a hydraulic

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[14] Showa Phys. Exh. A-33.

[15] See e.g., Saperstein, Tr. 257, 404; Showa Phys. Exh. A (Guntly Dep. 403-404).

diameter with an upper limit of 0.040 inches, (2) a discrete flow path, (3) complete bonding of an insert to the inside wall of the tube, and (4) serpentine fins on the air side of the tube. ID at 50.

The ALJ found the level of ordinary skill in the art pertinent to the '580 patent to be "relatively high", i.e., a person of such skill would have at least an undergraduate degree in mechanical engineering and at least one year of experience with heat exchangers and condensers. ID at 37. The ALJ found that "[t]he need for a smaller condenser that would transfer as much heat as a large one was the incentive to combine all of these elements [of claim 9] in a way that would enhance heat transfer." ID at 54. At this point in her analysis, before considering the objective indicia of nonobviousness, the ALJ concluded that respondents had proven by clear and convincing evidence that claims 9 and 10 are invalid as obvious. Id. Upon considering the evidence of objective indicia of nonobviousness submitted by complainant on the issues of long-felt need, unexpected benefits, and commercial success, ID at 54-72, the ALJ found that complainant had not established that objective indicia supported a finding of nonobviousness.

We adopt the ALJ's findings and conclusions in regard to the scope and content of the prior art, the differences between the prior art and the claimed inventions, and the level of skill in the art. We also adopt the ALJ's findings and conclusions on the issue of commercial success. However, for reasons discussed below, we determine to reverse the ALJ's finding that claims 9 and 10 are obvious in view of the prior art.

Respondents have the burden of proving by clear and convincing evidence that the claimed subject matter, taken as a whole, would have been obvious to one of ordinary skill in the art at the time that the invention was made. Ashland Oil, Inc. v. Delta Resins & Refactories Inc., 776 F.2d 281, 291 (Fed. Cir. 1985). Under In re Gorman, 933 F.2d 982, 987 (Fed. Cir. 1991), and other Federal Circuit precedent, it is impermissible to engage in a hindsight reconstruction of the claimed invention, using the applicant's structure as a template and selecting elements from references to fill the gaps. To find obviousness, "[t]here must be some reason, suggestion, or motivation found in the prior art whereby a person of ordinary skill in the field of the invention would make the combination. That knowledge can not come from the applicant's invention itself." In re Oetiker, 977 F.2d 1443, 1447 (Fed. Cir. 1992).

The ALJ identified only a general incentive to make the patented condenser, viz., "the need for a smaller condenser that would transfer as much heat as a large one." ID at 54. A finding that a claim is obvious in view of the prior art, however, requires a showing that there is a teaching, suggestion, or incentive in the prior art to make the combination claimed in the claim. See, e.g., In re Oetiker. Moreover, the fact that prior art structures might have been modified to form the claimed structure does not, absent a suggestion to make the modification, render the invention obvious. In re Lackowski, 871 F. 2d 115, 117 (Fed. Cir. 1989). We have reviewed the prior art of record and find that it contains no suggestion to combine the prior art in the manner of the claimed invention. Accordingly, we determine that the ALJ erred in finding that evidence of a general need or incentive to make a smaller and lighter condenser satisfied the requirement for a suggestion in the prior art to combine the elements in the manner of claims 9 and 10.

We also find that the ALJ erred in concluding, before analyzing the evidence of objective indicia, that "respondents have proved by clear and convincing evidence that claims 9 and 10 are invalid for obviousness under Section 103," and for stating that the evidence of objective indicia must "overcome the prima facie evidence" that claims 9 and 10 are invalid for obviousness. ID at 72. Federal Circuit case law makes clear that all evidence concerning the issue of obviousness must be considered before a conclusion can be drawn on the issue. In Stratoflex Inc. v. Aeroquip Corp., the Federal Circuit stated:

> Enroute to a conclusion on obviousness, a court must not stop until all pieces of the evidence on that issue have been fully considered and each has been given its

appropriate weight. . . .[D]ecision should be held in abeyance, and doubt maintained until all the evidence has had its say.

713 F.2d 1530, 1539 (Fed. Cir. 1983) (emphasis in original)

We disagree with the ALJ's finding that Modine did not establish a long-felt need for the claimed invention. The ALJ's finding that there was an incentive to build a lighter condenser implicitly recognized that there was a need for an improved condenser at the time that the grandparent application was filed in 1985. [16] Evidence of record demonstrates a need dating back to the early 1970s for a smaller, lighter, more efficient condenser because of government fuel efficiency standards and automobile manufacturers' desire to produce smaller, lighter cars in response to rising fuel prices.[17] In addition, environmental concerns over damage to the atmosphere's ozone layer caused by chlorofluorocarbons came into being in the early 1970's and increased the need to design condensers that used less of that type of refrigerant charge.[18] The evidence also supports a finding that customers were demanding better-performing condensers in the late 1970s.[19] Finally, customer requirements for space and comfort in the passenger compartment restricted the space available in the engine compartment for air conditioning components.[20]

We reject the ALJ's suggestion that the industry's desire to replace the serpentine condenser is inconsistent with a long-felt need for the invention of the '580 patent. Both Showa and Modine witnesses testified that the problem with the serpentine condenser was not its age per se, but the inability to improve its heat transfer efficiency per unit volume.[21] Thus, the record supports a finding that the need for an improved condenser made the existing serpentine condensers no longer acceptable.

We also disagree with the ID's finding that "the industry already was capable of making small flow paths that were required" because of the '311 method patent.[22] ID at 54. The application for Modine's '311 patent was filed on July 21, 1986, as a CIP of an application filed on March 3, 1986. Thus, the '311 patent application did not predate the October 1985 filing of the grandparent application of the '580 patent, and the record does not suggest that the method of making a heat exchanger disclosed in the '311 patent was known to one of ordinary skill in the art at the time the invention of the '580 patent was made.

We find that the ALJ erred in not giving any consideration to the unexpected benefits of the PF condenser invention in solving the refrigerant-side pressure drop problem encountered by condensers as hydraulic diameters approached the claimed range of the '580 patent, and in failing to weigh this consideration in concluding that the PF condenser invention was "predictable" from the

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[16] The ALJ stated on pages 53-54 "there was a need for a smaller and lighter condenser because of recent [environmental and fuel standards] legislation." While the ALJ concluded at page 55 that Modine and Showa both decided to develop a parallel flow condenser because they perceived the serpentine condenser to be a mature product, she recognized that a lighter, smaller, and more efficient condenser was desirable in view of the "need of the automobile industry to conserve fuel." ID at 56.

[17] See e.g., Saperstein, Tr. 151-152; Mod. Phys. Exh. C at 64; Mod. Doc. Exh. 26-B at 3; Mod. Doc. Exh. 34-A at 1).

[18] See e.g., Saperstein Tr. at 155-59. See also Mod. Doc. Exh. 27-A; Mod. Doc. Exh. 14-B. Showa Phys Ex. B1 at 2-3. Because of its smaller size, the patented condenser reduced the amount of refrigerant charge necessary in the system. Id.; Modine Doc. Exh. 3 ('580 patent, col. 8, lines 55-66).

[19] See e.g., Saperstein Tr. at 69-70; Mod. Phys. Ex. A (Asano Dep.) at 189-192; Showa Phys. Exh. A (Guntly Dep.) at 260; Mod. Phys. Exh. G (Okamoto Dep.) at 37-38; Mod. Phys. Exh. A12 at 4-5.

[20] Mod. Doc. Exh. 23 at 39; Mod. Phys. Exh. A12 at 5.

[21] Mod. Phys. Ex. C (Hoshino Dep.) at 87-88; Saperstein, Tr. 163-164.

[22] U.S. Letters patent 4,688,311, entitled " Method of Making a Heat Exchanger" issued to Modine as the assignee. Showa Doc. Exh. 23.

Cat condenser.[23] We determine, contrary to the ALJ's finding, that the record demonstrates that the improved performance of the PF condenser in reducing pressure drop was an unexpected result.

At the time that the PF condenser invention was made, it was well known that the reduction of hydraulic diameter was associated with an undesirable increase in refrigerant-side pressure drop.[24] Indeed, Showa's employees engaged in heat exchanger design were aware of this problem at the time.[25] Prior to designing the PF condenser, Modine's attempts to deal with this refrigerant-side pressure drop problem centered upon a different approach from the PF condenser design, namely, to divide the then state-of-the-art serpentine condenser into two circuits.[26] The record demonstrates that what was known regarding this problem "taught away" from the use of small hydraulic diameters on the scale claimed by the '580 patent. Thus, we find that the effective use of smaller hydraulic diameters, as taught by the '580 patent, was an unexpected result.

C. Indefiniteness Under Section 35 U.S.C. § 112

The ALJ made a contingent finding that the claims would be invalid for indefiniteness if the hydraulic diameter limitation of claims 9 and 10 was not interpreted to be limited to a range of from 0.015 to 0.040 inches. ID at 25. The ALJ correctly stated that claims are indefinite under 35 U.S.C. § 112, par. 2, if they do not particularly point out and distinctly claim the subject matter which the applicant regards as his invention. ID at 24. The ALJ found that the phrase "relatively small hydraulic diameter" is not indefinite because the phrase is clearly defined in the patent specification and prosecution history to be limited to the range of 0.015 to 0.040 inches. ID at 24. Upon review, we determine to affirm the ID's finding on indefiniteness.

V. Inequitable Conduct

The ALJ found that the patentees had made material misrepresentations and failed to disclose certain material facts in its presentation of Figure 5 of the '580 patent to the U.S. Patent and Trademark Office (PTO). The ALJ found these misrepresentations to be intentional, and consequently held the '580 patent to be unenforceable due to inequitable conduct. ID at 85. Specifically, the ALJ determined (1) that the patentees failed to include in Figure 5 of the performance of a two-circuit serpentine condenser which performed better than the prior art condensers to which the invention was compared in that Figure, and (2) that the patentees removed a prior art curve that was shown on the right side of a pre-application draft of Figure 5.[27] ID at 73-75. The prior art curve, which was based on a computer model and actual test data, sloped upward,

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[23] The ALJ concentrated on heat transfer performance as the only possible support for a finding of unexpected results, when in fact, refrigerant-side pressure drop was an equally important concern and a much more dramatic benefit of the PF condenser invention, as depicted in Figure 6 of the '580 patent. See Modine Doc. Exh. 3 ('580 patent, col. 8, lines 33-45 and Fig. 6).

[24] Each application leading to the '580 patent mentions the refrigerant-side pressure drop problem in the prior art and the objective of the invention to overcome it. Showa Doc. Exhs. 3 (Grandparent Application at 5), 4 (Parent Application at 114), and 5 (Child Application at 239); See also Modine Doc. Exh. 3 ('580 patent, col. 1, lines 21-29).

[25] Modine Phys. Exhs. G (Okamoto Dep. at 54-55, 57), H (Sasaki Dep. at 182-83), and J (Suzuki Dep. at 38-39, 47). In his testimony, Mr. Saperstein analyzed several patents and patent applications of Showa for its SC condenser, with claims going back to 1986. Saperstein Tr. at 1481-88; Modine Doc. Exhs. 25-A, -B, -C, -F. The Showa patent applications contained limitations on how small the inside passage of the tube could be, and the stated reason for these limitations was that increasing pressure drop caused a loss in heat transfer performance. Saperstein Tr. at 1487-88.

[26] Saperstein Tr. at 159. In a "serpentine" condenser the tubes of the condenser bend in a snake-like or serpentine fashion. Marto Tr. at 62. The term "circuits" in heat exchanger technology refers to the number of different flow paths that vapor entering a heat exchanger may pass through. Saperstein Tr. at 374. In a "two-circuit serpentine condenser" the inlet divides into two serpentine flow paths and ends at a common outlet. Saperstein Tr. at 481-82.

[27] Showa Phys Exh. A-33, also in record as Showa Phy. Ex. B-53 at M06030.

thereby demonstrating increased heat transfer as hydraulic diameter decreased. The prior art curve depicted on Figure 5 of the '580 patent, however, slopes downward and demonstrates that heat transfer decreased in the prior art as hydraulic diameter decreased. The ALJ found that the omission of performance data from two-circuit serpentine condensers in Figure 5 constituted a misrepresentation which was "relevant and supported the argument made by the applicant to the examiner that the invention had substantial unexpected benefits." ID at 75. The ALJ also found that "someone" associated with Modine removed the upward sloping curve from Figure 5. ID at 75. The ALJ found that the deleted curve demonstrated increased heat transfer with decreasing hydraulic diameter, contrary to the patentees' argument that heat transfer decreased with decreasing hydraulic diameter in the prior art serpentine condenser. Id. The ALJ found that the misrepresentations concerning Figure 5 were relevant and supported the applicants' argument that the invention had substantial unexpected benefits.

The ALJ concluded, without any discussion or consideration of Modine's explanation for the patentees' actions, that the misrepresentations concerning Figure 5 were intentional. Id. The ALJ based her conclusion of intent on Procter & Gamble Co. v. Kimberly-Clark Corp., 740 F. Supp. 1177, 1199 (D.S.C. 1989), aff'd without op., 907 F.2d 159 (Fed. Cir. 1990) (overly broad portrayal of test results held to be a reflection of an intentional effort to deceive) and Merck & Co. v. Danbury Pharmaceutical, Inc. 873 F.2d 1418, 1421-2 (Fed. Cir. 1989) (inequitable conduct found in the failure to disclose that the effects of the invention were comparable to those in the prior art). ID at 75.

Under Kingsdown Medical Consultants Ltd. v. Hollister, Inc., 863 F.2d 867, 872 (Fed. Cir. 1988)(en banc), cert. denied, 490 U.S. 1067 (1989), inequitable conduct resides in an applicant's failure to disclose material information, or submission of false material information, with an intent to deceive, and those two elements, materiality and intent, must be proven by clear and convincing evidence. Materiality can be established by a showing that there is a substantial likelihood that a reasonable examiner would have considered the omitted reference important in deciding whether to allow the application to issue as a patent. Merck & Co. v. Danbury Pharmaceutical, Inc. 873 F.2d 1418, 1421 (Fed. Cir. 1989). In order to find intent, the conduct in question, viewed in light of all the evidence, including evidence indicative of good faith, must indicate sufficient culpability to require a finding of intent to deceive. Kingsdown, 863 F.2d 867, 876. Intent may be inferred from evidence of the circumstances surrounding the conduct in issue. LaBounty Mfg., Inc. v. U.S. Int'l Trade Commission, 958 F.2d 1066, 1076 (Fed. Cir. 1992).

Figure 5 is described in the '580 patent specification as "a graph of the predicted [computer generated] performance of condensers with the same face area, some made in a prior art design and others made according to the invention, plotting heat transfer against cavity (hydraulic diameter)." Modine Doc. Exh. 3, ('580 patent, col. 2, lines. 54-58). Modine explained that, in generating the data for Figure 5, it sought to keep the air-side surface area of the condensers it tested constant in order to isolate the impact of varying hydraulic diameters upon heat transfer performance. Modine further explained that it depicted the performance of only parallel flow condensers in generating Figure 5 because it would have been fundamentally incorrect to compare the two-circuit serpentine condenser, which had a greater surface area that would skew the heat transfer value of the condenser upward, with the parallel flow condenser of the invention. [28]

Figures 6 and 8 of the '580 patent, by contrast, compare the performance of condensers made according to the invention with the performance of Modine's most efficient prior art condenser -- the two circuit serpentine condenser --which was omitted from Figure 5. Figures 6 and 8 compare condensers having the same heat transfer performance in order to show that the invention operates with a considerably lower refrigerant-side pressure drop and a lesser air-side pressure drop than the prior art. Figures 6 and 8 compare actual test data for a two-circuit serpentine condenser designated

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[28] Guntley Tr. 977-78; Mod. Doc. Exh. 3 at Table 1.

as "1E2803." Modine Doc. Exh. 3 ('580 patent, cols. 8, line 1-col. 9, line 48). The performance of the two-circuit serpentine condenser was clearly labelled in Figures 6 and 8 as the prior art's "BEST EFFORT." This description was absent from Figure 5.

Figure 6, along with Figure 5, was before the examiner throughout the prosecution of the '580 patent. [29] The data found in Figure 6 can be extrapolated to Figure 5 as Showa did in its papers and at the hearing in making its point. [30] Since the performance data of the two-circuit serpentine condenser was before the PTO in Figures 6 and 8, we disagree with the ID's finding that Modine made a material misrepresentation as to the performance of the prior art by omitting the data from Figure 5.

We find that the record here does not support a finding, by clear and convincing evidence, that Modine's omission of the two-circuit serpentine data was intended to deceive the PTO. In order to find intent, the conduct in question, viewed in light of all the evidence, including evidence indicative of good faith, must indicate sufficient culpability to require a finding of intent to deceive. Kingsdown, 863 F.2d 867, 876. The ALJ cited no evidence to support her finding that the omission of data was intentional, but inferred intent from the surrounding circumstances. The ALJ did not consider evidence of the applicants' good faith. We find evidence of good faith in Modine's citation of the most relevant prior art, the Cat condenser, to the PTO. The Cat condenser was manufactured by Modine and it is unlikely that the examiner would have learned of this prior art on his own. Moreover, Modine supplied an explanation for omitting the serpentine data from Figure 5, which the ALJ ignored. The ALJ also seems to have failed to consider the testimony of the prosecuting patent attorney and the inventor.[31]

We turn next to the removal of the computer-generated curve from Figure 5. Modine claimed that the curve, which showed that the heat transfer of the serpentine condenser increased with hydraulic diameter, was removed because it was based on computer generated predictions that were proven incorrect by actual test data. Mr. Guntly, an inventor of the '580 patent, testified that some of the pre-1985 computer predictions on which the deleted curve was based incorrectly predicted an increase in performance for serpentine condensers at particular hydraulic diameters. [32] In studying the range of small hydraulic diameters of the PF condenser invention prior to the filing of the grandparent application, Mr. Guntly testified that he had become concerned about the ability of the model to make accurate predictions at hydraulic diameters that fell below the range that had actually been used to develop the model for serpentine condensers, and was cautious about using the results based on this computer model in the patent application.[33] Mr. Guntly testified that he corrected the curve so that it would agree with actual test data showing that the heat transfer performance of serpentine condensers decreased as their hydraulic diameters decreased. Guntly Tr. at 959-960, 982-983, 990-91, 997-99. Respondents presented no evidence that Mr. Guntly's findings which are based on actual test data were false.

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[29] See Showa Doc. Exh. 3 (Grandparent Application at 23-24, originally Figs. 3 and 4); Showa Doc. Exh. 4 (Parent Application at 133-34, Figs. 3 and 4); Showa Doc. Exh. 5 (Child Application at 268-69, Figs. 5 and 6). Performance data of the serpentine condenser is also depicted in Table 1 of the '580 patent.

[30] See Showa Post-Trial Brief, Appendix C ("Data for 2-Circuit Serpentine Condenser from Figure 6 plotted onto Figure 5 . . ."); Guntly Tr. at 974-80.

[31] In contrast, Procter & Gamble Co. v. Clark, 740 F. Supp. 1177, 1199 (D.S.C. 1989), aff'd, 907 F.2d 159 (Fed. Cir. 1989), cited by the ALJ to support her finding of intent included numerous factual findings to support its conclusion that submission of a false affidavit was intentional. The Procter and Gamble court also stated unequivocally that it found the testimony of the patent attorney who submitted the false affidavit to be not credible. 740 F.Supp. at 1195. In LaBounty Mfg., Inc. v. U.S. Int'l Trade Commission, 958 F.2d 1066 (Fed. Cir. 1992), also cited in the ID, the ALJ stated that he found the testimony of the patentee and his attorney to be not "significant or persuasive." 958 F.2d at 1076.

[32] See e.g., Showa Phys. Ex. (Guntly Dep.) at 406; Guntly Tr. at 980.

[33] Showa Phys. Exh. A (Guntly Dep. at 387-88); Guntly Tr. at 981-82.

We find that Modine offered a reasonable explanation for removal of the curve, i.e., that such removal was necessary to bring the curve into agreement with actual test data. Respondents did not dispute the accuracy of the data that was substituted in place of the computer generated data, and the ALJ did not explain why she found a material misrepresentation in Modine's submission of more accurate data to replace the computer generated data. The ALJ also gave no explanation for rejecting Modine's explanation for removing the curve. Consequently, we find that the evidence of record does not support a conclusion that the omission of the curve was material or was done with intent to deceive the examiner. Rather, the record suggests to us that Modine sought only to avoid confusion in presenting data on Figure 5. [34]

Whether inequitable conduct has occurred is a question of equity. Kingsdown, 863 F.2d 867, 876. There can be no inequitable conduct when "a low degree of materiality is coupled with, at best, a low level of intent" (e.g. gross negligence). Specialty Composite v. Cabot Corp., 845 F.2d 981, 993 (Fed. Cir. 1988). Once the determinations of materiality and intent are established, the court must conduct a balancing test and determine whether the scales tilt to a conclusion that inequitable conduct occurred. Amgen Inc. v. Chugai Pharmaceutical Co. Ltd., 927 F.2d 1200, 1215 (Fed. Cir. 1991). Upon performing this balancing test, we determine that clear and convincing evidence does not support a finding that inequitable conduct occurred during the prosecution of the '580 patent. We note that the ALJ herself found "there was no evidence of a clear pattern of misconduct" in the prosecution of the '580 patent. ID at 84.

Respondents also accused Modine of inequitable conduct on several other bases which were not sustained in the ID. We affirm the ALJ's findings on materiality and intent in regard to those accusations, i.e., (1) that Figure 5 was based on an erroneous equation and Modine did not advise the examiner that the equation was erroneous after it discovered that fact, ID at 76-78; (2) that Modine gave the examiner false information relating to the crevice element of claims 9 and 10, ID at 78-80; and (3) that Modine misrepresented the teachings of the prior art references Oohara and Yoko. ID at 80-84 (through first full paragraph of p. 84 only).

We also affirm the ID's findings on materiality of the misstatements concerning the Cat condenser. ID at 80-82. A finding of inequitable conduct requires that there be a material misrepresentation made with intent to deceive, Kingsdown, 863 F.2d 867, 872. Since we have affirmed the ID's finding that any misstatements about the Cat condenser's teachings were not material, we decline to reach the issue of whether those statements were intentional.

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[34] In preparing Figure 5 for inclusion with the grandparent application, the accuracy of this model was a concern to Modine. The patent attorney prosecuting the Modine applications (Mr. vanStanten) testified as follows at his deposition:

> Q. Okay. Do you recall considering whether that curve should be included in the presentation made to the patent office?
>
> A. I have a vague recollection of considering that and if I'm correct in that recollection, the reason why it was not included is because we had actual test data and actual test data is obviously going to be more probative of what the heck is happening than some computer model which may not be.
>
> So we stuck, I believe, with the actual test data and did not want to confuse things with the computer model data.

Showa Phys. Exh. B (vanSanten Dep. at 44-45).

VI. Motion to Reopen

On May 6, 1993, after the ID had issued, Modine filed a motion to reopen the evidentiary record to admit a declaration that Showa had filed with the PTO in connection with prosecution of a Showa patent application on a type of condenser. [35] Modine asserted that the declaration is relevant to the issue of validity in that it demonstrates that respondents recognize the commercial success of the parallel flow condensers and their substantial advance over the prior art. Modine contended that there was good cause for reopening the record to admit this evidence in that Showa should have produced this document in response to a discovery request, but did not. Respondents and the IA opposed reopening the record.

The Commission does not have authority to expand the record now before it. Commission interim rule 210.53(g) authorizes the ALJ to reopen the record for receipt of additional evidence before the ID issues. However, there is no provision comparable to interim rule 210.53(g) that would allow the Commission to receive new evidence while the ID is pending before it. Moreover, the Administrative Procedure Act and Commission interim rule 210.41 guarantee the parties a hearing on the evidence before an ALJ. At the time that the motion to reopen the investigation was filed, there was not enough time remaining to afford respondents an opportunity for further hearing due to the statutory deadline in the investigation. Consequently, we determine to deny Modine's motion to reopen the record.

[35] Modine filed a similar motion before the ALJ one day before the ID was due to issue. That motion was denied.

APPENDIX

Claim 9.

A condenser for a refrigerant in a cooling system comprising:

a pair of spaced, generally parallel, elongated cylindrical tubes defining headers;

a vapor inlet in one of said tubes;

a condensate outlet from one of said tubes;

said header tubes each having a series of elongated generally parallel slots with the slots in the series on one header tube aligned with and facing the slots in the series on the other header tube;

a tube row defined by a plurality of straight tubes of flat cross-section and with flat sidewalls and having opposed ends extending in parallel between said header tubes, the ends of said flat cross section tubes being disposed in corresponding aligned ones of said slots and in fluid communication with the interiors of said header tubes, at least some of said tubes being in hydraulic parallel with each other;

web means within said flat cross-section tubes and extending between and joined to the flat side walls at spaced intervals to (a) define a plurality of discrete, hydraulically parallel flow paths within each flat cross-section tube that extend between said header tubes; to (b) absorb forces resulting from internal pressure with said condenser and tending to expand the flat cross-section tubes; and to (c) conduct heat between both said flat sides and fluid in said flow paths, and flow paths being of relatively small hydraulic diameter which is defined as the cross-sectional area of the corresponding flow path multiplied by four (4) and divided by the wetted perimeter of the corresponding flow path;

serpentine fins incapable of supporting said flat cross-section tubes against substantial internal pressure extending between facing flat side walls of adjacent flat cross-section tubes;

each of said flow paths including at least one elongated crevice extending generally along the length of the associated flow path.

Claim 10.

The condenser of claim 9 wherein each flow path has a plurality of said crevices.

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, DC 20436

In the Matter of	
CERTAIN CONDENSERS, PARTS THEREOF AND PRODUCTS CONTAINING SAME, INCLUDING AIR CONDITIONERS FOR AUTOMOBILES	Investigation No. 337-TA-334

NOTICE OF COMMISSION DECISION TO REVERSE PORTIONS OF AN INITIAL DETERMINATION

AGENCY: U.S. International Trade Commission.

ACTION: Notice.

SUMMARY: Notice is hereby given that the Commission has determined to reverse portions of the presiding administrative law judge's (ALJ's) initial determination (ID) in the above-captioned investigation. The Commission has determined to reverse the ID's findings on the issues of enablement under 35 U.S.C. § 112, first paragraph, anticipation under 35 U.S.C. § 102(b), obviousness under 35 U.S.C. § 103, and enforceability. The Commission has affirmed the ID's determination on indefiniteness under 35 U.S.C. § 112, second paragraph. The Commission has also determined that there has been importation of the accused condensers, a finding not made in the ID. The Commission's earlier determination to adopt the ID's dispositive findings on the issues of claim interpretation and infringement resulted in adoption of the ID's determination of no violation of section 337 of the Tariff Act of 1930 on June 25, 1993. 58 Fed. Reg. 36701-2 (July 8, 1993). Although the investigation has been terminated, the Commission has retained jurisdiction over the administrative protective order while it considers issues of post-termination document retention.

FOR FURTHER INFORMATION CONTACT: Jean H. Jackson, Esq., Office of the General Counsel, U.S. International Trade Commission, telephone 202-205-3104.

SUPPLEMENTARY INFORMATION: On December 12, 1991, Modine Manufacturing Company ("Modine") filed a complaint under section 337 of the Tariff Act of 1930 alleging infringement of claims of U.S. Letters Patent 4,998,580 in the importation and sale of certain condensers used in automobile air conditioning systems. On January 13, 1992, the Commission voted to institute an investigation of Modine's complaint. The Commission's notice of investigation was published in the Federal Register on January 23, 1992.

The final ID finding no violation of section 337 was filed on April 26, 1993. Complainant Modine and the Commission investigative attorney (IA) filed petitions for review of the ID on May 6, 1993. The IA filed a response to Modine's petition on May 13, 1993. Respondents filed a joint response to both petitions for review on May 18, 1993.

On June 25, 1993, the Commission determined to review the issues of validity, enforceability, and importation. 58 Fed. Reg. 36701-2 (July 8, 1993). Since the Commission did not review the dispositive issues of claim interpretation and patent infringement, the ID's finding of no violation of section 337 was adopted by the Commission.

Copies of all 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, 500 E Street S.W., Washington, D.C. 20436, telephone 202-205-2000. Hearing-impaired persons are advised that information on the matter can be obtained by contacting the Commission's TDD terminal on 202-205-1810.

This action is taken under the authority of section 337 of the Tariff Act of 1930 (19 U.S.C. § 1337) and Commission interim rule 210.56 (19 C.F.R. § 210.56).

By order of the Commission.

/s/

Donna R. Koehnke
Secretary

Issued: July 23, 1993

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, DC 20436

In the Matter of CERTAIN CONDENSERS, PARTS THEREOF AND PRODUCTS CONTAINING SAME, INCLUDING AIR CONDITIONERS FOR AUTOMOBILES	Investigation No. 337-TA-334

ORDER

On January 13, 1992, the Commission voted to institute an investigation of a complaint filed by Modine Manufacturing Company ("Modine") under section 337 of the Tariff Act of 1930 (19 U.S.C. § 1337). Modine's complaint alleged infringement of claims of U.S. Letters Patent 4,998,580 in the importation and sale of certain condensers used in automobile air conditioning systems. Notice of the investigation was published in the Federal Register on January 23, 1992. 57 Fed. Reg. 2784-85.

On April 26, 1993, the presiding administrative law judge (ALJ) issued an initial determination (ID) finding no violation of section 337 in the investigation. Complainant and the Commission investigative attorney filed petitions for review of the ID on May 6, 1993. Respondents filed a joint response to the petitions on May 18, 1993. On June 25, 1993, the Commission determined to review the issues of validity, enforceability, and importation. 58 Fed. Reg. 36701-2 (July 8, 1993). The Commission did not seek or receive any briefs on review.

The issues decided in the ID which were not reviewed by the Commission became the determination of the Commission. Since the Commission did not review the dispositive issues of claim interpretation and patent infringement, the ID's finding of no violation was adopted by the Commission.

Having considered the subject ID, the petitions for review, the replies thereto, and the record in this investigation, it is hereby **ORDERED THAT –**

1. The ID's conclusion that the parent patent application did not enable a two-pass condenser under 35 U.S.C. § 112, first paragraph, is reversed;

2. The ID's conclusion that the claims at issue are invalid under 35 U.S.C. § 102(b) is reversed;

3. The ID's conclusion that the claims at issue are invalid under 35 U.S.C. § 103 is reversed;

4. The ID's conclusion that the claims at issue are not indefinite under 35 U.S.C. § 112, second paragraph, is affirmed;

5. The ID's conclusion that the claims at issue are unenforceable due to inequitable conduct in their procurement is reversed;

6. The Commission finds that importation of the accused condensers has occurred;

7. Investigation No. 337-TA-334 is terminated on the basis that there is no violation of section 337;

8. The Commission will retain jurisdiction over the administrative protective order while it considers issues of post-termination document retention; and

9. The Secretary shall serve copies of this Order, and the Commission Opinion in support thereof (to be issued separately) upon each party of record in this investigation and on the Department of Health and Human Services, the Department of Justice, and the Federal Trade Commission, and publish notice thereof in the Federal Register.

By order of the Commission.

/s/
Donna R. Koehnke
Secretary

Issued: July 23, 1993

PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C. 20436

In the Matter of	)	
	)	
CERTAIN CONDENSERS, PARTS THEREOF AND PRODUCTS CONTAINING SAME, INCLUDING AIR CONDITIONERS) FOR AUTOMOBILES	)	Investigation No. 337-TA-334

INITIAL DETERMINATION

APPEARANCES

For Complainant Modine Manufacturing Company:

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OFFICE OF UNFAIR IMPORT INVESTIGATIONS

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PROCEDURAL HISTORY AND JURISDICTION

On December 12, 1991, complainant Modine Manufacturing Company filed a complaint alleging that respondents Showa Aluminum Corporation, Mitsubishi Heavy Industries Ltd., Mitsubishi Heavy Industries America Inc., Mitsubishi Motors Corporation and Mitsubishi Motors Sales of America had violated Section 337 of the Tariff Act as amended.

In its complaint Modine alleged that Showa manufactured for import into the United States certain automobile air-conditioning condensers and parts thereof that were imported into the United States and that infringed claims 6, 8, 9 and 10 of U.S. Letters Patent 4,998,580. (Showa Ex. 2). The inventors named in the patent are Leon A. Guntly and Norman F. Costello. The assignee of the patent is Modine Manufacturing Company, the complainant. The PF condenser is the parallel flow condenser made by Modine. (Tr. 63.) The SC, or Super Compact condenser, is the parallel flow condenser made by Showa. Modine originally asserted that Showa was infringing claims 6, 8, 9 and 10 of the '580 patent, but it withdrew all allegations of infringement of claims 6 and 8 shortly before trial.

On January 3, 1992, the Commission instituted an investigation to determine whether there had been a violation of Section 337 in the importation into the United States, the sale for importation, or the sale within the United States after importation of certain condensers, parts thereof or products containing same, including air conditioners for automobiles, by reason of infringement of claims 6, 8, 9 or 10 of U.S. Letters Patent 4,998,580, and whether there exists an industry in the United States as required by Section 337.

In February, 1992, the respondents filed motions for summary determination and termination of investigation (Motions No. 334-1 and 334-2). After these motions were briefed by the parties, they were granted on April 14, 1992. While the motions for summary determination were being reviewed, the parties agreed among themselves to suspend discovery. After review, the Commission reversed on November 18, 1992. Because so much time had elapsed, the Commission designated the case more complicated so that the statutory deadline could be met. The Commission ordered that a hearing be held and that an initial determination be issued by April 23, 1993. A one-week hearing ended on February 12, 1993. Posthearing briefs were filed by all the parties and briefing continued until April 5, 1993.

In the motions for summary determination, the only issue raised was whether condensers with flow paths having hydraulic diameters larger than 0.051 inch were covered by the '580 patent claims in issue. In the hearing, however, complainant alleged that respondents had imported infringing condensers with flow paths having hydraulic diameters smaller than 0.051 inch, and a large number of other issues were litigated.

The Commission has jurisdiction under Section 337 of the Tariff Act as amended over the subject matter set forth in the notice of investigation. The Commission has personal jurisdiction over all of the parties in the case. All parties participated in the hearing and filed briefs.

VALIDITY

The '580 patent was issued on March 12, 1991, and assigned to complainant Modine. The subject matter of the '580 patent is a condenser, which is a type of heat exchanger.

A typical air conditioning system includes a compressor, a condenser, an expansion valve, and an evaporator. Refrigerant liquid or vapor is cycled through these four components. Tr. 125-126. The compressor pumps hot refrigerant vapor into the condenser where air on the outside of the tubes cools the tubes. Tr. 125-126. As heat moves from the refrigerant through the condenser tubes into the air flowing through the condenser, the refrigerant cools from a vapor to a liquid before it leaves the condenser. Tr. 620-622. The liquid refrigerant goes out of the condenser through an outlet in a header tube, and flows through an expansion valve into the evaporator. Showa Phys. Ex. A at 181. In the tubes of the evaporator, the liquid refrigerant absorbs heat from the air flowing through the evaporator. Tr. 126-127. As it absorbs heat, the refrigerant changes into a vapor, enters the condenser through an inlet in a header tube, and the cycle is repeated. Tr. 125-127.

In the first part of the condenser, hot refrigerant vapor passes through flattened metal condenser tubes where heat is transferred to the air around the tubes. Inside these flattened tubes there may be "flow paths" which form discrete channels for the refrigerant. The rate at which heat is exchanged can be varied by changing the size, shape and number of the condenser tubes, the flow paths in these tubes, and the fins outside of the condenser tubes. For example, if a flow path in the condenser tube is too small, the refrigerant will meet resistance and not move through the flow path as quickly. The "refrigerant-side pressure drop" increases, and heat transfer declines. If two or more flow paths are formed inside the tube, instead of just one, each flow path can be smaller but the refrigerant-side pressure drop will be limited. This increases heat transfer through the tube to the outside air. The condenser designer tries to vary the size, shape and number of the

elements in the condenser to achieve the best rate of heat transfer in as small a space as possible.

The parallel flow condenser of claims 9 and 10 of the '580 patent has two headers opposite one another separated by a series of straight parallel tubes between the two headers. Headers are defined in claim 9 (which relates to a parallel flow condenser) as a pair of spaced, generally parallel, elongated cylindrical tubes.

CONSTRUCTION OF CLAIMS 9 AND 10

Only claims 9 and 10 of the '580 patent are in issue here. Claims 9 and 10 are as follows:

9. A condenser for a refrigerant in a cooling system comprising:

a pair of spaced, generally parallel, elongated cylindrical tubes defining headers;
a vapor inlet in one of said tubes;
a condensate outlet from one of said tubes;
said header tubes each having a series of elongated generally parallel slots with the slots in the series on one header tube aligned with and facing the slots in the series on the other header tube;
a tube row defined by a plurality of straight, [sic] tubes of flat cross-section and with flat side walls and having opposed ends extending in parallel between said header tubes, the ends of said flat cross section tubes being disposed in corresponding aligned ones of said slots and in fluid communication with the interiors of said header tubes, at least some of said tubes being in hydraulic parallel with each other;
web means within said flat cross-section tubes and extending between and joined to the flat side walls at spaced intervals to (a) define a plurality of discrete, hydraulically parallel flow paths within each flat cross-section tube that extend between said header tubes; to (b) absorb forces resulting from internal pressure within said condenser and tending to expand the flat cross-section tubes; and to (c) conduct heat between both said flat sides and fluid in said flow paths, said flow paths being of relatively small hydraulic diameter which is defined as the cross-sectional area of the corresponding flow path multi-

plied by four (4) and divided by the wetted perimeter of the corresponding flow path;
serpentine fins incapable of supporting said flat cross-section tubes against substantial internal pressure extending between facing flat side walls of adjacent flat cross-section tubes;
each of said flow paths including at least one elongated crevice extending generally along the length of the associated flow path. (Emphasis added).

10. The condenser of claim 9 wherein each flow path has a plurality of said crevices.

The "terms of a claim must be interpreted with regard to the other claims, the specifications and the prosecution history." Jonsson v. Stanley Works, 903 F.2d 812, 819, 14 U.S.P.Q.2d 1863, 1870 (Fed. Cir. 1990). Unless the terms of a claim are so plainly self-defining that no reference to other sources is necessary, each of these components will be relevant to the interpretation of the claims. E.I. DuPont de Nemours & Co. v. Phillips Petroleum Co., 849 F.2d 1430, 1438, 7 U.S.P.Q.2d 1129, 1135 (Fed. Cir.), cert. denied, 488 U.S. 986 (1988); McGill, Inc. v. John Zink Co., 736 F.2d 666, 673-675, 221 U.S.P.Q. 944, 948-50 (Fed. Cir.), cert. denied, 469 U.S. 1037 (1984).

In construing the claims in this case it is important to note what the applicant for the patent, or more accurately Modine's attorney speaking for his client, told the examiner in the prosecution history about what he meant when he used certain words and phrases. The applicant told the examiner what his invention was, what each claim was intended to cover, what was in the prior art, how the applicant distinguished the prior art from his invention, and what subject matter he surrendered in order to obtain allowance of the claims. The prosecution history includes what became the '580 patent specification and all the claims that were allowed.

Patent claims are presumed to be valid. If there is a construction of a claim that would allow the claim to be found to be valid, and the applicant

did not give up this construction in the prosecution history, the presumption of validity lends weight to this construction of the claim.

Claims 9 and 10 must be given the same construction for the purposes of validity and infringement. Claims should be construed in light of what was said by the patentee in the prosecution history before specific infringement issues are considered. Lemelson v. United States, 752 F.2d 1538, 1549, 224 U.S.P.Q. 526, 532 (Fed. Cir. 1985). Anyone who wanted to design around a patent and had gone to the prosecution history to determine what the claims meant before he designed his own product to avoid the claims is entitled to depend on the claim being construed in the context of the prosecution history and the patent itself.

The principal phrases in claims 9 and 10 requiring construction are "relatively small hydraulic diameter" and "web means within said flat cross-section tubes and extending between and joined to the flat side walls."

The meaning of the phrase "relatively small hydraulic diameter"

Both claims 9 and 10 describe flow paths of "relatively small hydraulic diameter." The phrase "relatively small" in claim 9 is not precise and must be construed to determine how small the hydraulic diameter must be. The specific issue is whether the term "relatively small hydraulic diameter" can be construed as covering condenser tubes with flow paths having hydraulic diameters of greater than 0.040 inch. Hydraulic diameter is defined in claim 9 itself at p. 6 above.

The Prosecution History:

The prosecution history will be discussed here in some detail in connection with the construction of the term "relatively small hydraulic

diameter", but it is relevant to other issues and will not be repeated in this detail elsewhere.

The Grandparent application: Modine filed the Grandparent application for what became the '580 patent on October 2, 1985. Showa Ex. 3. Each claim in the Grandparent recited condenser tubes with "flow paths having a hydraulic diameter in the range of about 0.015 to 0.07 inches." Id. at 17-19. The specification described this range of 0.015 to 0.070 inch as the range of the invention. Id. at 6, 9, 11. "As can be appreciated from Fig. 3, heat transfer is increased in the range of hydraulic diameters of about 0.015 inch to about 0.07 inch through the use of the invention with some variance depending upon air flow." Id. at 11. Figure 3 was a graph that compared the heat transfer performance of the claimed invention to that of the prior art. Id. at 28.

The examiner rejected all nine claims of the Grandparent, stating that the claimed invention and the claimed range of hydraulic diameters were obvious in light of the prior art. Id. at 35-37. Modine then abandoned the application. Id. at 45.

The Parent Application: Modine filed the Parent application on September 5, 1986. Showa Ex. 4. The specification and claims of the Parent were almost the same as those in the Grandparent application, with one exception: The 0.015 to 0.070 inch hydraulic diameter range disappeared completely, without explanation. In every place where that range had appeared in the Grandparent, the range of 0.015 to 0.040 inch now appeared. Id. at 115, 119-20, 122. The text accompanying Figure 3 was changed to show improved heat transfer in the narrower range. Id. at 122.

When the examiner objected to the Parent specification under 35 U.S.C. § 112, stating that he was "unclear how the specification supports the criticality of the hydraulic diameter range 0.015-0.040 inches" (id. at 149), Modine argued "the criticality of hydraulic diameter and the range specified." Id. at 161. Modine stated that Figure 3 "shows that peak heat transfer according to the invention is achieved in this range of hydraulic diameters and it is this peak area that is sought to be covered by the applicant." Id.

Modine did not expressly surrender its claims to hydraulic diameters between 0.040 and 0.070 inch in the Parent application until Modine disclosed to the examiner the prior art Cat condenser. The Cat condenser had individual flow paths with hydraulic diameters of 0.0382 to 0.0448 inch, and Modine told the examiner that it had an "overall" hydraulic diameter of 0.0496 inch. Showa Ex. 4 at 167.

Three Modine witnesses, Leon Guntly (one of the inventors named in the '580 patent), Philip Saperstein (a Modine executive and an inventor named in the '311 patent) and William VanSanten (the attorney who prosecuted the patent), testified that Modine surrendered the range of hydraulic diameters between 0.040 and 0.070 inch to avoid the prior art. Showa Phys. Ex. A at 594-95; Showa Phys. Ex. B at 66-67; Showa Phys. Ex. C at 200-201.

But the examiner still rejected all of Modine's claims, stating that they were obvious in light of the Caterpillar condenser and other prior art, and that the difference between the claimed invention's largest possible hydraulic diameter of 0.040 inch and the Cat condenser's overall hydraulic diameter of 0.049 inch was "an obvious matter of design choice." Showa Ex. 4 at 185.

Modine then argued that the Cat condenser's individual flow paths that had hydraulic diameters smaller than 0.040 inch should not be considered as

teaching or making obvious Modine's claimed invention because the bonding of the inserts in the Cat condenser was not complete. Modine also argued that the overall hydraulic diameter of the Cat condenser was so much larger than Modine's claimed upper limit of a hydraulic diameter of 0.040 inch that the hydraulic diameter of the Cat condenser should not affect the patentability of Modine's claimed range. Id. at 190-92. Finally, Modine argued that its invention was distinguishable over the Cat condenser because the upper limit of the range of hydraulic diameter claimed by Modine was "smaller than even the average hydraulic diameter of the passages in the prior art condenser ...." Id. at 192.

The examiner again rejected all claims in this application, and Modine abandoned the Parent application. Id. at 193-196.

The Child Application: Modine filed the Child application on January 7, 1988. Eventually, ten claims were allowed.

Prosecution claims 1-10 and 15-21 recited a hydraulic diameter between about 0.015 and 0.040 inch. Id. at 257-264. Other claims included the small hydraulic diameter element, but in descriptive language without numbers. Claims 25-28 used the term "relatively small hydraulic diameter." Id. at 414-416.

The specification disclosure in the Child application (which became the specification for the '580 patent) referred to a hydraulic diameter in the range of 0.015 to 0.040 inch. Id. at 240, 246, 252; Showa Ex. 2 at col. 1, ll. 62-64; col. 4, ll. 46-50; col. 7, ll. 64-68. This range reflected hydraulic diameters smaller than the "overall" hydraulic diameter of the Cat condenser.

In the one place that the specification did not recite the 0.015 to 0.040 inch range, it referred to "a relatively small hydraulic diameter for the flow paths as mentioned previously." Showa Ex. 5 at 247; Showa Ex. 2 at col. 5, ll. 22-24. The only hydraulic diameter mentioned previously in the specification was the numerical range set forth a few paragraphs earlier. This stated:

> According to the invention, each of the flow paths ... have hydraulic diameters in the range of about 0.015 to 0.040 inches. Given current assembly techniques known in the art, a hydraulic diameter of approximately 0.025 inches optimizes ultimate heat transfer efficiency and ease of construction.

Showa Ex. 5 at 246; Showa Ex. 2 at col. 4, ll. 43-48.

On May 4, 1988, the examiner rejected all of the claims in light of the Cat condenser and other references. The examiner understood that Modine was claiming only hydraulic diameters of 0.015 to 0.040 inch:

> [T]he applicant discusses flow path hydraulic diameters to be 0.0382-0.0448 and 0.0496 for the known condenser. . . . [T]o particularly modify the flow paths of Yoko to operate effectively as a condenser by choosing a hydraulic diameter between 0.015 and 0.040 inches would have been obvious to one of ordinary skill in view of the known range of 0.038 to 0.0448 discussed by applicant's [disclosure of the flow paths in the Cat condenser] (i.e., 0.04 falling within these known values for condenser flow paths).

Showa Ex. 5 at 288.

On October 6, 1988, Modine filed an amendment. Id. at 358-366. Modine did not suggest that any of its claims covered subject matter outside the range of 0.015-0.040 inch; instead, Modine argued that the relevant hydraulic diameter in the Cat condenser was not its individual flow paths with hydraulic diameters less than 0.040 inch, but its 0.049 inch "overall" hydraulic diameter. This was larger than the largest hydraulic diameter that Modine claimed. Modine made no distinction between its claims containing a numerical range and its claims describing a small hydraulic diameter in words. Modine

represented that none of its claims covered hydraulic diameters larger than 0.040 inch:

> ... the fact that a Cat Folded Front condenser may have had one or more passages with hydraulic diameters of less than 0.040 [inches] is not dispositive since the overall hydraulic diameter was 0.049 inches .... [S]ince the overall hydraulic diameter [of the Cat condenser] is 25% above the top end of the range claimed [by Modine], that should be the one that is accorded anticipatory effect if any, particularly since improved results with the PF condenser are demonstrated at hydraulic diameters of 0.035 inches and 0.039 inches (the latter being almost right at the top end of the claimed range) over the Cat Folded Front having an overall hydraulic diameter of 0.049 inches.

Id. at 363-364.

The examiner again rejected all claims, indicating that the claimed hydraulic diameter was taught by the Cat condenser because the claimed range of 0.015 to 0.040 inch was not patentably distinguishable over the 0.049 inch overall hydraulic diameter of the Cat condenser. Id. at 397-403.

On July 17, 1989, Modine added prosecution claims 25-28. Prosecution claims 25, 27 and 28, after revisions, became claims 9 and 10 of the '580 patent. Claim 25 recited a "relatively small hydraulic diameter." The examiner pointed out that the "relatively small" hydraulic diameter element was no larger than 0.040 inch. He noted that prosecution "claim[s] ... 19-25," which included the "relatively small" hydraulic diameter element, were unpatentable because to modify "the flow paths of Yoko to operate effectively as [a] condenser by choosing a hydraulic diameter between 0.015 and 0.040 inch would have been obvious to one of ordinary skill" and because "it would have been obvious to one of ordinary skill in the art of heat exchange to reduce a hydraulic diameter of a flow path to within the claimed range of 0.015 to 0.04." Id. at 454-455, 458. The examiner never suggested that "relatively small" meant anything other than 0.015 to 0.040.

Modine told the examiner that claim 25 was broader than original claim 10 in some respects and narrower in others. Showa Ex. 5 at 416. Modine stated that claim 25 was directed to the improved strength characteristic of the invention, while claims 27 and 28 were directed to the crevice feature. One difference between claim 25 and original claim 10 was related to strength: the "undulating insert" in claim 10 was broadened to "web means ... joined to the flat side walls" in claim 25. Claim 25 was broader than original claim 10 in other ways as well; for example, claim 25 was not limited to condensers using the refrigerant R-12. Id. 414-428.

Claim 27, which depended from claim 25 but added a crevice element, became patent claim 9. Claim 28, which became claim 10, depended from claim 25 and added only the limitation of a plurality of crevices.

In the July 17, 1989 amendment Modine for the first time pointed out that the microcracks recited in many of its claims offered unexpected heat transfer advantages. Id. at 426. Until that time the examiner consistently had rejected the range of 0.015 to 0.040 inch as obvious in light of the size of the hydraulic diameter of the Cat condenser, even though the Cat's hydraulic diameter was above the range claimed by Modine. When Modine made the microcracks argument, the examiner for the first time allowed some of the claims. He rejected all of Modine's arguments except this one:

> Applicant's arguments concerning the flux coating o[n] the interior of the passages, in light of the Japanese document and translation filed in paper no. 12, these arguments have been found to be persuasive. Therefore, claims 16, 17, 18[,] 20-24[,] 27 and 28, are believed to contain allowable subject matter.

Id. at 457-458 (emphasis added).

Prosecution claim 27 became claim 9 and prosecution claim 28 became claim 10. These claims were allowed even though they did not contain a microcracks

limitation. They were limited to a small hydraulic diameter, as was every other claim that was allowed. But the other claims were only allowed when they included a microcracks limitation. Claims 27 and 28 were allowed although they do not expressly claim microcracks, and the examiner never said that he had changed his mind about the obviousness of Modine's range of 0.015 to 0.040 inch. Yet Modine's arguments persuaded the examiner only after the microcracks argument was made. The word "therefore" in the last sentence quoted above indicates that the examiner thought he was allowing claims 27 and 28 because of the microcracks argument. The examiner offered no explanation as to why two claims that did not have a microcracks limitation were allowed.

Although claims 9 and 10 included a crevices limitation, the examiner had previously rejected a combination of small hydraulic diameter and crevices. In the same office action that allowed the claims that became claims 9 and 10, the examiner rejected prosecution claims 25 and 26. Prosecution claim 27 (which became patent claim 9) was allowed. It recited the condenser of claim 25 (found to be obvious) plus a crevice element. Prosecution claim 26, which was rejected, recited the condenser of claim 25 (found to be obvious) plus an undulating spacer. Claim 26 was found to be obvious by the examiner although it recited an undulating spacer and such a spacer had crevices. The examiner did not explain why he allowed claim 27 while rejecting claim 26. The undulating spacer depicted in Figure 2 showed crevices, and the patent specification expressly described the undulating spacer as including crevices. Showa Ex. 2 at Col. 5, 11. 28-31. The action of the examiner appears to be inconsistent, and may be due to the limited amount of time that an examiner has to review patent applications.

In rejecting prosecution claims 25 and 26, the examiner stated that he was relying on two Japanese patents, No. 58-221390 to Oohara and No. 57-198922 to Yoko, and on the Cat condenser. Child App., Showa Ex. 5, at 454-59. The only difference between claim 25, which the examiner rejected, and prosecution claim 27 which was allowed as patent claim 9, was the presence of the crevice element. Yoko and Oohara disclosed tubes with undulating bonded inserts that had crevices. In addition, Mr. Saperstein testified that the tube and spacer construction depicted as prior art in Fig. 3 of Modine's 740,000 application disclosed crevices. Saperstein Tr. 171-72.

These prior art references did not discuss the surface tension functions associated with crevices in the patent specification or point out the advantages of crevices. (The Uehara patent, that was not before the examiner, did.' See p. 45 above.) In any event, the '580 patent covers a structure, not a process. "Mere recognition of latent properties in the prior art does not render nonobvious an otherwise known invention." In re Baxter Travenol Labs, 952 F.2d 388, 392, 21 U.S.P.Q.2d 1281, 1285 (Fed. Cir. 1991). Even if the inventors named in the '580 patent had discovered and claimed a new benefit of an old process, neither the new benefit nor the old process would be patentable. In re Woodruff, 919 F.2d 1575, 1578, 16 U.S.P.Q.2d 1934, 1936 (Fed. Cir. 1990).

Examination of the prosecution history suggests that the allowance of claims 27 and 28 (which became claims 9 and 10) may have been an oversight on the part of the examiner. If the examiner intended to allow claims 27 and 28 without the microcracks limitation, there is no way to determine which of his prior conclusions about the obviousness of the elements in claims 27 and 28 he

had given up. Yet claims 9 and 10 were allowed and are presumed to be valid.

The wording of the other claims:

The Federal Circuit held in Tandon Corp. v. U.S.I.T.C., 831 F.2d 1017, 1023, 4 U.S.P.Q.2d 1283, 1288 (Fed. Cir. 1987), that there is no presumption of "element differentiation." Two different elements in different claims can mean the same thing. Because of the assertions of the applicant in the prosecution history and the statements made by the examiner, the phrase "relatively small hydraulic diameter" in claims 9 and 10 is construed as covering only the range of 0.015 to 0.040 inch, the same range that is expressly set forth in other claims.

The doctrine of claim differentiation does not support a finding that "relatively small hydraulic diameter" must mean something other than the numerical range claimed in the prosecution history and disclosed in the patent specification because there are other distinctions between claims 9 and 10 and the other claims. See Hormone Research Foundation, Inc. v. Genentech, Inc., 904 F.2d 1558, 1567 n.15, 15 U.S.P.Q.2d 1039, 1047 n.15 (Fed. Cir. 1990), cert. dism'd, 111 S. Ct. 1434 (1991).

Ordinarily, a claim that did not name a specific numerical range, and used a term such as "relatively small," could be construed as claiming a broader range than a claim where a specific numerical range is given. But in this case it would be unfair to the public to construe the more flexible language in claim 9 as covering condenser tubes with flow paths having larger hydraulic diameters than 0.040 inch when the applicant had assured the examiner (and the public) in the prosecution history that his claims were limited to tubes with flow paths having hydraulic diameters in the range of 0.015-0.040 inch and that the upper limit of 0.040 was critical.

It would make no sense to construe one claim as including "the precise subject matter that was relinquished in order to obtain allowance" of another claim. See Builders Concrete, Inc. v. Bremerton Concrete Products Co., 757 F.2d 255, 260, 225 U.S.P.Q. 240, 243 (Fed. Cir. 1985).

When the examiner rejected claims based on the size of the hydraulic diameter, he stated that the difference between Modine's claimed upper limit of 0.040 inch and the hydraulic diameter of the Cat condenser was too insignificant to support patentability. See Showa Ex. 5 at 399-400, 455. He wrote that to "modify the flow paths of Yoko to operate effectively as [a] condenser by choosing a hydraulic diameter between 0.015 and 0.040 inch would have been obvious." Id. at 455, 458. He never distinguished Modine's non-numerical hydraulic diameter claims from its numerical ones. Based on the wording of the other claims and the examiner's comments on them, claims 9 and 10 should be limited to a hydraulic diameter in the range of 0.015 to 0.040.

The patent specification:

The patent specification supports the same construction of the phrase "relatively small hydraulic diameter." Both the examiner and the public were entitled to rely upon the assurances of the applicant that the scope of the claims that Modine sought to have allowed over the prior art Cat condenser would be limited to a specific range. See Texas Instruments Inc. v. U.S.I.T.C., _____ F.2d ____, 1993 WL 63006, 26 U.S.P.Q.2d 1018 (Fed.Cir. 1993).

The patent specification initially was part of the prosecution history. It states that "[a]ccording to the invention, each of the flow paths ... have hydraulic diameters in the range of about 0.015 to 0.040 inches," and identifies 0.025 inch as the "optim[al]" hydraulic diameter. Showa Ex. 2,

col. 4, ll. 42-50. Three of the next four paragraphs refer to that numerical range. Col. 4, l. 55, Col. 4, l. 59, Col. 5, ll. 13-14. The next paragraph refers to "the utilization of a relatively small hydraulic diameter for the flow paths as mentioned previously." Col. 5, ll. 22-24. The only hydraulic diameter "mentioned previously" in the specification is the range of 0.015 to 0.040 inch with an optimal size of 0.025 inch. Mr. VanSanten testified that the words "relatively small hydraulic diameter ... as mentioned previously" in the specification referred to that numerical range. Showa Phys. Ex. B at 148-150.

Modine argues that the upper limit of the range "mentioned previously" should be the 0.070 inch found in the '311 patent. The application for the '311 patent was filed while the Grandparent application of the '580 patent was pending. (The Grandparent application claimed a range with an upper limit of 0.070, but this was abandoned in the Parent and the Child applications.) The '311 patent incorporates by reference the Grandparent application with its 0.070 upper limit, and the '311 patent still was incorporated by reference into the '580 patent when it was issued. Showa Ex. 4 at 119. The '311 patent still refers to hydraulic diameters up to 0.070 inch, while the '580 patent does not. Showa Ex. A-44, col. 4, ll. 33-39.

The '311 patent was incorporated by reference into the '580 patent because it taught a method of tube and spacer construction, not because of its hydraulic diameter range. Showa Phys. Ex. A-44, col. 2, ll. 38-43. The '311 patent discloses "[a] highly preferred means by which the tubes 20 with accompanying spacers 40 may be formed." Showa Ex. 2, col. 4, ll. 35-41. A statement in another patent that is incorporated by reference to teach tube and spacer construction cannot be used to construe the hydraulic diameter

range for the '580 patent, especially when the range in the '311 patent is inconsistent with the plain language in the specification and prosecution history of the '580 patent. The '311 patent was incorporated by reference only to show a method of bonding inserts to tubes as internal supports to solve fabrication problems in tubes with small flow paths. Showa Phys. Ex. A at 601-02. The hydraulic diameter limitation was incidental to the invention disclosed in the '311 patent. Four claims of that patent contain no hydraulic diameter limitation at all. Showa Phys. Ex. A-44 at col. 10. If Modine had wanted to claim a range of 0.015 to 0.070 in the '580 patent, it could have done so, while stating that the best mode was up to 0.040 inch. The hydraulic diameter range was an essential part of the '580 patent. Its meaning would not have been left for clarification by a patent that was only incorporated by reference. Modine did not want to claim the larger range because it wanted to have its claims allowed over the prior art Cat condenser.

Professor Marto, an expert witness in this case, testified that a person who wanted to understand the '580 patent would have read the '311 patent because it was incorporated by reference into the '580 patent, but he himself had not read the Wallace patent, the Kawase patent or the 740,000 application that were incorporated by reference in the '580 patent. Marto Tr. 879-80.

It is not reasonable to assume that a person of ordinary skill in the art would have determined the meaning of "relatively small hydraulic diameter" in claim 9 by studying the '311 patent rather than the '580 patent itself.

Modine also argues that its intent to claim hydraulic diameters up to 0.070 inch in claim 9 was disclosed in Figure 5. This position is inconsistent with Modine's own statements to the examiner and in the written specification. The specification describes Figure 5 as showing that: "heat

transfer is advantageously and substantially increased in the range of hydraulic diameters of about 0.015 inch to about 0.040 inch through the use of the invention." (Emphasis added.) Showa Ex. 5 at 252; Showa Ex. 2 at col. 7, ll. 64-67. There is no suggestion that heat transfer would be advantageously increased outside the disclosed range. In distinguishing the Cat condenser from the '580 invention, Modine argued that "improved results with the PF condenser are demonstrated at hydraulic diameters of 0.035 inch and 0.039 inch (the latter being almost right at the top end of the claimed range) over the Cat Folded Front [condenser] having an overall hydraulic diameter of 0.049 inches." Showa Ex. 5 at 364. Nothing in Figure 5 teaches the reader that Modine was disclosing an upper limit of 0.070 inch. Modine now says that it was merely identifying the preferred embodiment of its invention when it referred to the 0.015 to 0.040 inch range, but it never taught the reader of the patent any other range. This is inconsistent with the written description of Figure 5 in the specification. Showa Ex. 2 at col. 7, lines 65-67. The same numerical range appears in the "Summary of the Invention," (Showa Ex. 2 at col. 1, lines 63-64) and it appears in a description of the applicable range "[a]ccording to the invention." Id. at col. 4, ll. 42-47. The number 0.070 is never mentioned.

In the Parent application Modine had described the 0.015 to 0.040 inch range shown in the drawing that became Figure 5 of the patent as the "peak area that is sought to be covered by the applicant." Showa Ex. 4 at 161. Modine expressly narrowed its claims to this numerical range to get its claims allowed.

To summarize, in Grandparent application the applicant claimed a hydraulic diameter range of 0.015 to 0.070. This range was rejected because

numbers in this range were found in the prior art. After the Grandparent application was abandoned, the applicant consistently took the position that it was claiming a condenser with flow paths having a hydraulic diameter in the range of 0.015 to 0.040 inch, and was not claiming any condenser with a flow path that had a hydraulic diameter with an overall average above 0.040 inch. Subject matter relating to condenser tubes with flow paths having a hydraulic diameter larger than that were abandoned by the applicant to distinguish his invention from the prior art and to obtain allowance of his claims. The prosecution history limits the interpretation of claims to exclude any interpretation that may have been disclaimed or disavowed during prosecution in order to obtain claim allowance. Jonsson v. Stanley Works, 903 F.2d at 818, 14 U.S.P.Q.2d at 1869. Standard Oil Co. v. American Cyanamid Co., 774 F.2d 448, 452, 227 U.S.P.Q. 293, 296 (Fed. Cir. 1985). The meaning of "relatively small hydraulic diameter" in claims 9 and 10 therefore must be limited to the numerical range of 0.015 to 0.040 inch.

2. The phrase "web means within said flat cross-section tubes and extending between and joined to the flat side walls."

Part of Claim 9 requires:

> a tube row defined by a plurality of straight tubes of flat cross-section and with flat side walls . . . [and] web means within said flat cross-section tubes and extending between and joined to the flat side walls . . .

The wording of the other claims of the patent has little effect on the construction of this phrase, but the '580 patent prosecution history and specification are important in construing this phrase. The prosecution history shows that this phrase was added in prosecution claim 25 and that the change was made because the phrase web means joined to the flat side walls added an element of strength to the earlier claim. See pp. 14-15 above. The

patent specification discloses tubes that have "flat side walls" to which "web means" in the form of an undulating spacer are "joined." Mr. Saperstein confirmed that the web means extend to and are joined to the flat interior walls. Saperstein Tr. 512-13. The specification teaches that the relatively flat walls to which the insert is joined probably enable the crevices to pull condensate to the corners, and this thins the liquid film in flat areas, allowing better heat transfer. The flat walls are the walls on the inside of the tubes, labeled "86" in Figure 3. Showa Ex. 2, col. 5, l. 46 - col. 6, l. 23.

SECTION 112(2)

Patent claims are indefinite unless they "particularly point[] out and distinctly claim[] the subject matter which the applicant regards as his invention." 35 U.S.C. § 112(2). "When the meaning of claims is in doubt, especially when, as is the case here, there is close prior art, they are properly declared invalid." Amgen, Inc. v. Chugai Pharmaceutical Co., Ltd., 927 F.2d 1200, 1218,18 U.S.P.Q.2d 1016, 1031 (Fed. Cir.), cert. denied, 112 S. Ct. 169 (1991).

The phrase "relatively small hydraulic diameter" is not so indefinite as to make claims 9 and 10 invalid under Section 112(2). The phrase is so clearly defined by the applicant in the prosecution history and in the patent specification and limited to the range 0.015 to 0.040 that it would be difficult for anyone to find that the phrase was indefinite when read in the context of the patent specification or the prosecution history.

Although Modine witnesses offered a broad range of interpretations of the meaning of "relatively small" (see for example, Marto Tr. 861, 864, 866, 711-712, VanSanten dep., Showa Phys. Ex. B at 83-83, 198-99), the prosecution

history and the patent itself are available to anyone who wants to understand this phrase. The public should be able to rely on what the patentee said in these documents when the patentee himself interpreted an ambiguous phrase. The patentee should not be able to change his interpretation of an ambiguous term after the patent claims are allowed. If the various interpretations suggested in this record by Modine witnesses were used, it would be impossible to arrive at a single clear definition of the phrase "relatively small," and the claims in which this phrase appeared would be invalid as indefinite under Section 112(2).

Another problem under Section 112(2) is raised by the specification of the '580 patent. It suggests that the range of hydraulic diameters recited in the patent refers only to condensers using the refrigerant R-12, while "[s]omewhat different values might be expected in systems using different refrigerants." Showa Ex. 2, col. 4, ll. 55-58. If the meaning of the phrase "relatively small" depended on the type of refrigerant used, a manufacturer might build a condenser that is noninfringing so long as the system uses R-12, but becomes infringing when the system uses a different refrigerant. See Marto Tr. 866, VanSanten dep., Showa Phys. Ex. B. at 83-84. There would be no way for someone trying to design around the patent to be sure that a flow path with a hydraulic diameter in a particular range would not infringe the patent. Because of restrictions on chlorofluorocarbons, production of R-12 will cease at the end of 1995 (Saperstein Tr. 156-158), and all condensers built during the remaining 13 years before the '580 patent expires will have to use other refrigerants. If the meaning of "relatively small hydraulic diameter" changes in some unknown and unpredictable way when a new refrigerant is used, claims 9 and 10 would be invalid as indefinite under Section 112(2). Moreover, when

the patentee expressly limited his claims to cover only the size of hydraulic diameters in a specific range in order to get his claims allowed, the patentee should not be able to enlarge his claim beyond this range after the claim is allowed so that the claim can cover refrigerants that are not now known. See Mathis v. Hydro Air Industries, Inc., 1 U.S.P.Q.2d 1513, 1517 (C.D. Cal. 1986), aff'd without op., 818 F.2d 874 (Fed. Cir.), cert. denied, 484 U.S. 826 (1987).

Claims 9 and 10 have been construed herein as covering a specific range of hydraulic diameters regardless of the type of refrigerant that is used. As so construed, the phrase "relatively small hydraulic diameter" does not make the claims invalid for indefiniteness under Section 112(2).

THE EARLIEST DATE THAT THE APPLICANT CAN CLAIM FOR INVENTION

Before validity under Section 102 or 103 can be considered, the question of what is in the prior art must be decided. This depends upon whether Modine can rely upon the date of filing of the Parent or Grandparent application as the date that will determine what is prior art for the purposes of determining validity and infringement of claims 9 and 10. If Modine cannot use the date of filing of the Parent or Grandparent application to determine what is prior art, then certain prior art can be used against the patent claims that would not have been available if the applicant had been able to use the filing date of an earlier application. There is then a possibility that claims 9 and 10 are invalid as anticipated under Section 102(b). Whether the applicant can use the earlier filing date in this case turns on whether each element claimed in claims 9 and 10 was adequately disclosed in the Grandparent or Parent application as required in Sections 120 and 112 of the Patent Act.

SECTION 112(1)

When patent claims are allowed after successive applications, the critical date to which the "public use or sale" bar applies is the date of the last application, unless the specification of the immediately preceding application disclosed the invention "in the manner provided by the first paragraph of section 112." 35 U.S.C. § 120. A patentee seeking the benefit of a prior application's filing date must satisfy the Section 112(1) "written description" requirement in the earlier disclosure with respect to all limitations found in the ultimately allowed claims. See Pennwalt Corp. v. Akzona Inc., 740 F.2d 1573, 1580-81, 222 U.S.P.Q. 833, 835-837 (Fed. Cir. 1984).

Modine has admitted that the invention of the '580 patent was "in public use or on sale in this country" before January 7, 1987. See Modine Responses to Showa's First Requests for Admission, Showa Phys. Ex. BB at 2.

If the Parent specification failed to satisfy the description requirement of Section 112(1) for each element of claims 9 and 10, then under Section 120 of the Patent Act the patentee will not be entitled to the filing date of the Grandparent or Parent application, and both claims will be invalid under Section 102(b).

Claims 9 and 10 were added as amendments to the Child application. The critical date for that application is January 7, 1987, one year before the Child application was filed, unless Modine is entitled to use the date of filing of an earlier application.

The first paragraph of 35 U.S.C. § 112 provides that the specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms

as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Inherent in Section 112 is the doctrine of continuity, under which the claims of a continuation-in-part application are entitled to the benefit of the filing date of the earlier application if the disclosure in the earlier application would have supported the later claims. See 35 U.S.C. § 120; Smith v. Goodyear Dental Vulcanite Co., 93 U.S. 486, 499-500 (1876); Watson v. Bersworth, 251 F.2d 898, 900 (D.C. Cir.), cert. denied, 356 U.S. 972 (1958). To the extent that a continuation-in-part application discloses new matter that was not disclosed in the original application, the applicant cannot claim the filing date of the earlier application.

In considering whether claims 9 and 10, which were added in the Child application, are entitled to the filing date of the Parent or Grandparent application by meeting the requirements of the first paragraph of Section 112, the first question is whether the Parent application disclosed each element of those claims in a manner "sufficiently clear that persons of skill in the art will recognize that [the patentee] made the invention having those [later-added] limitations". In re Spina, 975 F.2d 854, 857, 24 U.S.P.Q.2d 1142, 1144 (Fed. Cir. 1992). The earlier disclosure "must convey" the later-added limitations. In re Wilder, 736 F.2d 1516, 1520, 222 U.S.P.Q. 369, 372 (Fed. Cir. 1984), cert. denied sub nom Wilder v. Mossinghoff, 469 U.S. 1209 (1985). See also In re Wright, 866 F.2d 422, 425, 9 U.S.P.Q.2d 1649, 1651 (Fed. Cir. 1989). To meet the requirement of the first paragraph of Section 112, at the time the Parent application was filed the inventors must have had "possession

of the specific subject matter later claimed by them in the C.I.P." See In re Blaser, 556 F.2d 534, 194 U.S.P.Q. 122 (C.C.P.A. 1977).

"To satisfy the description requirement of section 112, first paragraph, an application must contain sufficient disclosure, expressly or inherently, to make it clear to one skilled in the art that the [applicant] was in possession of the subject matter claimed." In re Eickmeyer, 602 F.2d 974, 202 U.S.P.Q. 655, 662 (CCPA 1979). See Litton Systems, Inc. v. Whirlpool Corp., 728 F.2d 1423, 1438 (Fed. Cir. 1984). This requirement is more difficult to meet based on an inherent description of the feature rather than an express disclosure in writing. Kennecott Corp. v. Kyocera Intern., Inc., 835 F.2d 1419, 1423, 5 U.S.P.Q.2d 1194, 1198 (Fed. Cir. 1987), cert. denied, 486 U.S. 1008 (1988). See also Martin v. Mayer, 823 F.2d 500, 505, 3 U.S.P.Q.2d 1333, 1337 (Fed. Cir. 1987). Whether an element has been adequately disclosed under Section 112 is an issue of fact. Fiers v. Sugano, 25 U.S.P.Q.2d 1601, 1606 (Fed. Cir. 1993). It depends "on the nature of the invention and the amount of knowledge imparted to those skilled in the art by the disclosure." In re Wertheim, 541 F.2d 257, 262, 191 U.S.P.Q. 90, 96 (C.C.P.A. 1976).

1. CREVICES

The Child application for the first time includes a crevice element in some of the application claims. The Child application discusses the functions of crevices and the advantages of flow paths with crevices over circular flow paths. It discusses the effects of surface tension and capillary action in crevices. See Showa Ex. 5 at 247-49, 260-61 (application claims 11, 12 and 14), 263 (application claim 22).

Neither the Parent nor the Grandparent application has a written description of the crevices feature, or mentions the word crevices. The

Parent did not suggest in words that any particular shape of flow path was desirable. But for the drawing of an undulating spacer in Figure 2, there would be nothing in the Parent or Grandparent applications to suggest the presence of crevices. The inventors of the '580 patent testified that they had not thought that any particular shape of flow path would offer advantages over any other shape until the possible benefits of crevices were suggested by Professor Marto. Guntly Tr. 967; Guntly dep., Showa Phys. Ex. A at 723-24; Costello dep., Showa Phys. Ex. F at 92-93, 161. Professor Marto first suggested to Modine that crevices might have advantages on September 18, 1986, after the Parent application had been filed on Sept. 5, 1986. See Guntly Tr. 967-68; Marto dep., Showa Phys. Ex. H at 72-73; Showa Phys. Ex. H-123 at M013310 (Prof. Marto's written statement about the significance of non-circularity).

Modine's original parallel flow condenser used round tubes without crevices. Showa Phys. Ex. A-12 at M011265; id. A-13 at M054499. Modine had developed its internal formula for calculating the internal heat transfer coefficient in PF condenser tubes using data from testing of round tubes. Guntly Tr. 997; Guntly dep. Showa Phys. Ex. A at 454-55.

Nevertheless, the disclosure of an undulating spacer in the Parent application, represented in Figure 2 as a preferred embodiment and included as an element in two of the claims, satisfies Section 112(1). Crevices were depicted in the drawing. "[A] feature claimed in the second application which was not claimed in the first, but which appeared in the specification or drawings of the first, is considered to be disclosed therein, regardless of what is claimed." Acme Highway Products Corp. v. D.S. Brown Co., 431 F.2d 1074, 1079 (6th Cir. 1970), cert. denied, 401 U.S. 956 (1971); see Chicago &

N.W. Ry. Co. v. Sayles, 97 U.S. 554, 557, 563 (1878). It is irrelevant that the inventors were trying to show a web system that added strength to the tube, and that they were not aware of any advantages resulting from the crevices that formed in the angles of the web when it was attached to the wall. The inventors had possession of the concept of using crevices in a flow path because they pictured these crevices in the flow path in the preferred embodiment of the invention. Depicting crevices in the flow path in the context of Figure 2 as a preferred embodiment was enough to disclose the crevice element later found in claims 9 and 10. All three applications and the patent itself included Figure 2, which inherently discloses crevices in the flow path. Showa Ex. 3 at 22; Showa Ex. 4 at 132; Showa Ex. 5 at 266. Crevices are shown at item 4 of Figure 2. Saperstein Tr. 492.

Although the first description of the surface tension and capillary action effects present at the crevices appeared in the Child application, the crevices did not constitute new matter because the applicant did not expand the subject matter disclosed in the Grandparent and Parent applications. The applicant merely explained the advantages of the preferred mode shown in Figure 2. By adding the crevice limitation in claims 9 and 10, Modine limited these claims to condensers that contained non-circular flow paths. Saperstein Tr. at 421. A round or circular flow path would have no crevices. Nothing in the Grandparent or Parent application limited the scope of any claim to non-circular flow paths. See Showa Ex. 3, at 17-19. Claims 9 and 10 narrow the subject matter originally disclosed and claimed in the Grandparent application. It is therefore not new matter. See Wayne-Gossard Corp. v. Sondra, Inc., 434 F.Supp. 1340, 1355, 195 U.S.P:Q. 777 (E.D. Pa. 1977), aff'd, 579 F.2d 41 (3d Cir. 1978).

The first discussion of the advantages of crevices, surface tension and a flow path with a noncircular shape was in the Child application. Showa Ex. 4 at 118. Respondents argue that if one skilled in the art would not have expected noncircularity to enhance heat transfer, then the importance of noncircular flow paths or crevices could not have been inherently described by Figure 2, or by the inclusion of an undulating spacer element in two claims. See In re Karpik, 463 F.2d 1355, 1358, 175 U.S.P.Q. 23, 25 (C.C.P.A. 1972). But as long as the structure of the invention was disclosed in the earlier application, it is not necessary that an inventor know why (or that he disclose why) his invention works. He need not explain what elements in his disclosed invention are important. It is enough that he teaches others how to use his invention. Diamond Rubber Co. v. Consolidated Rubber Tire Co., 220 U.S. 428, 435-36 (1911); Fromson v. Advance Offset Plate, Inc., 720 F.2d 1565, 1570, 219 U.S.P.Q. 1137, 1140 (Fed. Cir. 1983; In re Isaacs, 347 F.2d 887, 892, 146 U.S.P.Q. 193, 197 (C.C.P.A. 1965). Crevices were disclosed in the context of flow paths in a condenser tube. One who followed the teachings of Figure 2 and made the structure claimed would get any benefits resulting from crevices.

Respondents did not meet their burden of proving by clear and convincing evidence that the crevice limitation in claims 9 and 10 was not described in the earlier patent applications within the meaning of Section 112(1).

2. RELATIVELY SMALL HYDRAULIC DIAMETER

If the "relatively small hydraulic diameter" element in claims 9 and 10 were interpreted as covering flow paths with hydraulic diameters larger than 0.040 inch, this range would not be described in the Parent application within the meaning of Section 112(1). But this phrase has been construed as having a

lower limit of 0.015 and an upper limit of 0.040. As construed herein, this phrase was described adequately in the earlier applications within the meaning of Section 112(1).

3. USE OF THE TWO-PASS METHOD

This leaves respondents' contention that allowing the inlet and outlet of the condenser to be in the same header was not described expressly or inherently in the Grandparent and Parent applications. Two phrases in claim 9, "a vapor inlet in one of said tubes" and "a condensate outlet from one of said tubes," relate to a two-pass parallel flow condenser. In a parallel flow condenser, a pass is the distance travelled by the fluid going from one header to the other, regardless of whether there is an outlet in the second header. Saperstein Tr. 374. In a one-pass parallel flow condenser, each flow path has an inlet in one header and an outlet in the opposite header after a single pass. In a two-pass condenser, a flow path has an inlet in the first header, the flow path turns around after the first pass and returns to the first header where there is an outlet.

The elements "a vapor inlet in one of said tubes" and "a condensate outlet from one of said tubes" in claim 9 allow the inlet and the outlet to be in the same header. This means that claim 9 can cover a one-pass or a two-pass parallel flow condenser.

The applicant expressly described this feature for the first time in the Child application, stating that "[i]n some cases, the inlet and outlet may be in the same header and separated by a suitable baffle or plug." Showa Ex. 5 at 243. In a two-pass condenser, if the tube is divided by a baffle, the refrigerant can go down one flow path, turn around at the end of one pass and return in the flow path on the other side to the first header to the outlet.

In the July 1989 amendment Modine added the prosecution claims that were allowed as patent claims 9 and 10. In these claims Modine for the first time claimed a condenser that could have the inlet and the outlet in the same header. Id. at 414.

Complainant argues that the two-pass condenser was inherently disclosed in the Parent application in Figure 3 (which became Figure 5 of the '580 patent). Curve B of Figure 3 was described in the Parent application as applying to a condenser core of the invention where "the length of the flow path in each tube was doubled, i.e., the number of tubes was halved and tube length was doubled." Showa Ex. 4 at 121-122. This description would be consistent with a two-pass condenser, but the record does not support a finding that this disclosed to one with ordinary skill in the art that the invention included two-pass condensers with the inlet and the outlet in the same header. The description also would be consistent with a condenser with half the number of very long tubes. Mr. Guntly first testified at his deposition that he had in mind the long tubes in a condenser in a truck when he used the language quoted above in describing Curve B in Figure 3. Showa Phys. Ex. A at 372-73. Later he testified that the language would be consistent with a two-pass condenser. To argue that one with ordinary skill would have known that a smaller number of longer tubes would not have worked as well as a two-pass condenser would be inappropriate; Figure 3 was intended to show the advantages of the invention over the prior art.

While the description of Curve B in Figure 3 of the Parent application was ambiguous, in the same application Modine expressly argued to the examiner that it was not claiming multi-passing when it distinguished the Oohara patent on the basis that "Oohara's device is principally a multipass evaporator

whereas the applicant's invention is a single-pass condenser." Showa Ex. 4 at 161.

The concept of a two-pass condenser as part of the invention was new matter not previously described or inherently disclosed. Under Section 120, claims 9 and 10 therefore are not entitled to the earlier filing dates of the Grandparent and Parent applications. Neither the Parent nor the Grandparent taught or disclosed or claimed either expressly or by implication that a baffle or plug could be inserted in the condenser to change it from a one-pass to a two-pass condenser.

Modine therefore is not entitled to the benefit of the filing date of the Grandparent or Parent application for claims 9 and 10. The next question is whether this makes claims 9 and 10 invalid under Section 102(b).

SECTION 102(b)

Under 35 U.S.C. § 102(b), a patent is invalid if the invention was in public use or on sale in the United States more than one year prior to the date of the application for a U.S. patent. 35 U.S.C. § 102(b). If a claim in a continuation-in-part application relies on new matter, any claims arising out of that new matter are entitled only to the filing date of the "continuation-in-part" application. If the product is on sale more than one year before the filing date of the later application, this invalidates that claim. State Industries, Inc. v. A.O. Smith Corp., 751 F.2d 1226, 1233, 224 U.S.P.Q. 418 (Fed. Cir. 1985); Great Lakes Carbon Corp. v. Continental Oil Co., 219 F.Supp. 468, 138 U.S.P.Q. 613 (W.D.La 1963), aff'd, 345 F.2d 175 (5th Cir.), cert. denied, 382 U.S. 905 (1965). New matter is defined as "new and substantive information which might change the invention." Wayne-Gossard v. Sondra, supra, 434 F.Supp. at 1355.

The subject matter of claims 9 and 10 was on sale in the United States more than one year before the filing of the Child application. Complainant admitted that the PF condenser disclosed in the '580 patent was on sale in the United States before January 7, 1987. This is more than one year prior to the filing of the Child application. Showa Phys. Ex. BB, Complainant's Response to Request for Admission No. 69; Tr. 65, 101-02. Modine cannot obtain the benefit of the filing date of applications filed before the Child application with respect to claims 9 and 10 because at least one of these elements (an inlet and an outlet in the same header) was not described either expressly or inherently in those applications as required by Section 112(1). Claims 9 and 10 are therefore invalid under Section 102(b) as anticipated.

OBVIOUSNESS UNDER SECTION 103

Under 35 U.S.C. § 103, a patent is invalid if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

The question of whether claims 9 and 10 are invalid because the alleged invention thereof would have been obvious to persons having ordinary skill in the art of heat exchanger or condenser design is a closer question than the Section 102(b) question because there is no single prior art reference suggesting the combination of all of the elements of claims 9 and 10.

An analysis of obviousness under 35 U.S.C. § 103 requires consideration of four elements:

(1) the level of ordinary skill in the pertinent art;
(2) the scope and content of the prior art;
(3) the differences between the claims and the prior art; and

(4) secondary considerations, if any, of nonobviousness. Secondary considerations include objective indicia of nonobviousness such as commercial success, long-felt but unsolved need, and failure of others.

Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1050, 5 U.S.P.Q.2d 1434, 1438 (Fed. Cir.), cert. denied, 488 U.S. 825 (1988) (citing Graham v. John Deere Co., 383 U.S. 1, 17-18 (1966)).

THE LEVEL OF ORDINARY SKILL IN THE PERTINENT ART

The level of skill in the art of a hypothetical person having ordinary skill in the pertinent art is an issue of law. The level of skill in the art of a hypothetical person having ordinary skill in the pertinent art (designing condensers or heat exchangers) in this case is relatively high. There was testimony from people who were working in this field in about 1985 as to what education and experience they and others working in the same field had. Most had at least an undergraduate degree in mechanical engineering, and a year or more of practical experience with heat exchangers and condensers. By reading technical journals they kept up with recent developments in their field. Although Modine argues now that the level of skill was lower than this, during the prosecution of the Child application, Modine argued that the level of ordinary skill in condenser design was high and quoted from a 1984 technical paper to support this position. Showa Ex. 5 at 419-420.

The subject matter covered by the '580 patent is a condenser, which is a heat exchanger. The examiner looked for pertinent prior art in single-phase heat exchangers and two-phase heat exchangers. Showa Ex. 2 at 1. A single-phase heat exchanger is one in which the fluid does not change phases; i.e., a liquid remains a liquid, and a gas remains a gas. An example is the radiator in an automobile. Saperstein Tr. 74-75, Marto Tr. 615-617. A two-phase heat exchanger is one in which the fluid changes from a gas to a liquid, or vice

versa. The condensers at issue here are two-phase condensers in which a hot gas becomes a liquid as it cools. Id.

In developing its Caterpillar condenser and its PF condenser, both two-phase heat exchangers, Modine itself used elements from the single-phase heat exchanger of the Caterpillar radiator. Saperstein Tr. 423-24.

THE SCOPE AND CONTENT OF THE PRIOR ART

All the prior art relied upon in this section was in existence before October 2, 1985, the date of filing of the Grandparent application. This prior art includes references cited by the examiner and some that were not before the examiner.

The Cat Condenser: The prosecution history of the '580 patent discusses the most relevant prior art, the Caterpillar or Cat condenser. In 1979, Modine built the Cat condenser. Modine had been selling the Cat condenser for several years before it sought a patent for the PF condenser. The Cat condenser is a parallel flow condenser, containing parallel tubes arranged between headers. Tr. 228. Each tube contained a sinusoidal or corrugated insert partially brazed to the interior tube wall. Tr. 229. The insert created crevices. Tr. 429. The insert increased surface area for heat transfer and reduced the hydraulic diameter of the tube. A smaller hydraulic diameter tends to increase the resistance to fluid flow inside the tube, or cause "increased pressure drop" on the refrigerant side. Mr. Guntly removed four baffles in the headers to increase the free flow area (the area available for the refrigerant to flow through), and this limited the refrigerant-side pressure drop. Showa Phys. Ex. A at 215-16; Showa Phys. Ex. A-17.

The Cat condenser was made of steel and it had plate air fins. Air fins are fins on the outside of a condenser tube. Saperstein Tr. 167. The Cat

condenser was designed to be used as a module along with the heavy-duty steel radiators and oil coolers already being used in Caterpillar earth-moving equipment. See Child application, Showa Ex. 5 at 520. Steel, which is not a good heat conductor, had to be used to meet the needs of the Caterpillar as earth-moving equipment. Saperstein Tr. 228, dep. at Showa Phys. Ex. C, pp. 43-44, 47-48. Plate fins had to be used on the outside (or air side) of the tubes so that the condenser would fit into the existing Caterpillar equipment. They offered no heat transfer advantages and they caused a problem: After the tubes had been inserted into the holes in the plate fins where they were supposed to be aligned, the tubes had to be widened by a steel expansion device to ensure good contact with the plate fins. When Mr. Guntly put an insert inside the condenser tubes, he could not press the tubes down to obtain good bonding between the insert and the tubes. If he had done so, the tubes would have lost contact with the outside plate fins. Saperstein dep., Showa Phys. Ex. C at 69-70. Complete bonding would have increased heat transfer, but this could not be achieved because of the plate air fins. Showa Phys. Ex. A-17 at M021543; Parent App., Showa Ex. 4 at 190-91.

Modine told the examiner in the Child application that the Cat condenser tube had an "overall" hydraulic diameter of 0.04822 inch, (changed from Modine's earlier overall measurement of 0.0496) and urged the examiner to use this number as the hydraulic diameter of the Cat, rather than measurements of individual sections of the Cat tube. The Modine measurement for the overall hydraulic diameter of the Cat was 0.008 inch above the upper limit of the hydraulic diameter range of claims 9 and 10 (0.040 inch) as construed herein.

The two-circuit serpentine condenser: Before 1980, Modine had a single-circuit serpentine condenser. A single-circuit serpentine condenser has an

inlet through which incoming vapor enters a single flow path, and the condenser tube follows a long serpentine path to the outlet. Modine Ex. 39; Saperstein Tr. 481.

By 1985, Modine had made a two circuit serpentine condenser in which the hydraulic diameter of the flow paths had been reduced to about 0.078 inch. Saperstein Tr. 372-73. A two-circuit serpentine condenser has an inlet where the fluid is divided into two flow paths, following one of two serpentine tubes to a common outlet. Saperstein Tr. 482; Staff Ex. 17. The hydraulic diameter for Modine's two circuit serpentine condenser was close to the upper limit (0.070) that Modine now claims for the '580 patent. When Modine reduced the hydraulic diameter, at the same time Modine added the second circuit in order to limit the refrigerant-side pressure drop. Saperstein Tr. 373; Guntly dep., Showa Phys. Ex. A at 75, 93-94. By adding a second circuit Modine was using multi-circuiting. A multiple circuit condenser allows incoming vapor to enter two or more flow paths. Saperstein Tr. 375. The two-circuit serpentine condenser disclosed the use of multi-circuiting to compensate for the reduction in hydraulic diameter.

Conventional condensers and radiators: By 1985, Modine (and others) were making aluminum condensers with aluminum external serpentine fins. Saperstein Tr. 376-377. Protection against pressure from the inside of the tubes was provided by putting either partitions (in the case of extrusions) or bonded inserts inside the tubes to strengthen them. Multicircuiting with discrete flow paths had been used in aluminum automotive condensers in 1985. Saperstein Tr. 409, dep. at Showa Ex. C, p. 31. See Figure 3 of Showa Phys. Ex. A-45.

Oohara: Japanese laid-open patent application number 58-221390 of Oohara, published on December 23, 1983 (Showa Phys. Ex. J, Tab. 32) disclosed an evaporator or condenser. It noted the difficulty of extruding tubes with flow paths small enough to take advantage of improved heat transfer from additional internal surface area (p. 6). To solve this problem, the patent taught the use of an undulating insert. Each bulge of the insert would touch the tube wall. The insert then would be brazed to the tube wall to create discrete flow paths (pp. 3-4). This structure permitted further reduction in the size of flow paths through the use of additional "legs" in the insert (p. 6). Oohara also taught the use of serpentine air fins (p. 4). Although it was not a parallel flow condenser, it taught all of the other structural features of claims 9 and 10.

Modine argued during the prosecution of the '580 patent that Oohara was distinguishable from Modine's invention because Oohara was directed to an evaporator. See Showa Ex. 4 at 161; Showa Ex. 5 at 425. But the Oohara patent specification expressly states that the invention "may be applicable to many applications such as a coolant condenser" (p. 7).

Modine told the examiner that Oohara did not suggest the discrete flow paths of applicant's invention because Oohara Figs. 5-8 depicted openings that "open adjacent flow paths to one another." Showa Ex. 4 at 162-63. But the preferred embodiment illustrated in Figure 3 of Oohara clearly depicts discrete flow paths with no openings between adjacent flow paths. Every embodiment disclosed in a patent is a prior art reference. See Merck & Co., Inc. v. Biocraft Laboratories, Inc., 874 F.2d 804, 807, 10 U.S.P.Q.2d 1843, 1846 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989).

Modine argued to the patent examiner that "As nearly as we can determine, the smallest hydraulic diameter contemplated by Oohara, given the dimensions employed in the specification, is a hydraulic diameter of .118 inches." Showa Ex. 4 at 162. Professor Webb, however, calculated the Oohara hydraulic diameter to be approximately 0.062 inch, or smaller if instructions to flatten the tube and to use more legs on the insert to obtain more surface area are followed. Webb Tr. 1216-19; Showa Ex. 27. Using Mr. Webb's calculations, the hydraulic diameter of Oohara would be at most 0.022 inch above the 0.040 upper limit of the hydraulic diameter range of claims 9 and 10 as construed herein.

Yoko: Japanese laid-open patent application number 57-198992 of Yoko, published on December 6, 1982 (Showa Phys. Ex. J, Tab. 30) is a method patent for forming a flat-tube type heat exchanger. It teaches parallel tubes between and joined to end plates (p. 101), flat tubes with brazing material, an undulating plate inside the flat tubes, forming multiple parallel fluid passages (p. 101), and serpentine external fins (referred to as "cooling undulating-plate 6") (p. 103). It discloses a parallel tube, a bonded insert, and an external serpentine fin structure.

Modine argued to the examiner (Showa Ex. 5 at 424) that Yoko does not clearly disclose the complete bonding of the undulating insert to the tube, and Mr. Saperstein testified to this at the hearing. Tr. 1469-76. This argument is inconsistent with the language of the Yoko patent. The patent teaches that the exterior fins are bonded to the tube by placing brazing material only at the "upper end portions" of the tube and air fins so that during brazing "the brazing material melts and flows down between" the tube and the air fins, p. 104. But the same process is not followed inside the tube. See p. 103. Brazing material is placed throughout the inside of the

tube along with the insert (p. 101). During brazing that material "melts and fixes" between the insert and the tube (pp. 104-05). This suggests that a complete bonding takes place between the insert and the tube. The examiner never received an English translation of the patent. Child application, Showa Ex. 5 at 457.

Uehara: The Uehara patent, U.S. Patent 4,492,268, issued on January 8, 1985, (Showa Phys. Ex. J, Tab 9), was directed to a condenser having generally rectangular flow paths with spacers that created concave corners. See Fig. 4. Although the patent claimed a plate-type condenser, it stated that it was applicable to a tube-type condenser. Col. 3., 11. 36-40. The patent discloses a parallel flow condenser. Webb Tr. 1245-46. The Uehara patent specification discussed the surface tension effects that would result from having corners in the flow paths. "The resulting condensate is drawn by the action of surface tension to the corners between the ridges...and the surface of the plates...against which they abut." Col. 4, 11. 62-63; Webb Tr. 1229-34.

The Uehara patent disclosed that performance of the condenser would improve using refrigerants with a surface tension under 35 dynes per centimeter (which includes automotive condenser refrigerants) if the pitch between the corners in the flow paths fell within certain parameters. Those pitch measurements can be translated into hydraulic diameter values, and result in a prediction of optimal performance at a hydraulic diameter of 0.023 inch or less. See Showa Ex. 86; Webb Tr. 1231-32. This is close to the 0.025 inch optimum that Modine disclosed in the '580 patent. Col. 4, 11. 47-49. A curve in Figure 3 of the Uehara patent shows the relationship between size of flow path and heat transfer that is similar to the curves of Figure 5 of the

'580 patent. Modine argued that Figure 5 taught the unexpected benefits of reducing hydraulic diameter. So does Figure 3 of Uehara.

The Uehara patent teaches the advantages of surface tension pulling condensate into corners and thinning the condensate film on adjoining walls in a tube-type condenser, and the advantages of flow paths of the size claimed in the '580 patent.

The existence of pertinent prior art, such as the Uehara patent, that was not before the examiner when the patent was allowed makes it easier to prove that the patent was obvious. Lindemann Maschinenfabrik v. American Hoist and Derrick Co., 730 F.2d 1452, 1459, 221 U.S.P.Q. 481, 487-488 (Fed. Cir. 1984).

Other references not before the examiner taught the surface tension effects attributed to crevices. Japanese Utility model 56-6790 to Hisaka (Showa Phys. Ex. J, Tab 17, laid open Feb. 14, 1981; Webb Tr. 1234-35) discloses a plate type condenser but states that it can be applied to a tube type condenser (pp. 2, 9). It discloses surface tension pulling condensate into concave corners. It teaches that as a result, the liquid film on the adjoining walls is thinned and heat transfer is increased. See Figs. 7 and 8 and pages 3-7.

Prior art disclosing the use of brazed inner fins

In addition to the Yoko and Oohara patents, other prior art references taught the use of inner fins brazed to the interior of condenser tubes. Webb Tr. 1242-44. Modine's U.S. Patent 2,488,615 teaches that as a result of the bonded insert, "the relatively thin walls of the tube are considerably strengthened and held against rupture." Showa Ex. 20 at col. 4, lines 24-26. Mitsubishi 58-169386 (Showa Phys. Ex. J, Tab 21, at 3) taught that a brazed insert increased the "proof pressure strength" of the tube. See Nippondenso

(U.K.) 2,133,525 (Showa Phys. Ex. J, Tab 7), and Modine's 740,000 application, Showa Phys Ex. A, Tab 45.

Prior art disclosing small hydraulic diameters

Professor Marto testified that in the early 1980's, engineers were familiar with the concept of a compact heat exchanger. In a compact heat exchanger, the surface area per unit volume is increased to a level where you have "very effective heat transfer in a small volume." Marto Tr. 758. The "surface area per unit volume" is "an equivalent of hydraulic diameter." Tr. 758-59. He testified that the constraints in building compact heat exchangers related to manufacturing cost. Marto dep., Showa Phys. Ex. H at 30-31; Marto Tr. 759.

The 1985 Handbook of Heat Transfer Applications discuss the effects of surface tension on compact surfaces and their relationship to heat transfer:

> [F]or compact surfaces, the surface-tension effects become important in the corner regions, particularly at low Reynolds numbers when the passages are not "flooded." The surface-tension forces pull the condensate to the corners (which act locally as drainage channels) and maintain thin films on the rest of the surface. The resultant heat transfer coefficient can be significantly higher than those for the gravity-controlled condensation with finite interfacial shear stress.

Showa Phys. Ex. J, Tab 18 at 4-296; Webb Tr. 1235-36.

The term "hydraulic diameter" is used in this reference, and was not coined by Modine in the '580 patent. Showa Phys. Ex. J at Tab 19. Other prior art references disclose flow paths with small hydraulic diameters when they suggest an increase in surface area per unit volume. Marto Tr. 758-759.

Nippondenso 59-13877, the Uehara 4,492,268 patent, and Oohara 58-221390, expressly point out the benefits of increasing internal surface area in flow paths. See Showa Phys. Ex. J at Tabs 8, 9, and 32. These references teach one with ordinary skill in the art that he should increase the internal

surface area of flow paths to improve heat exchange. This teaches the advantages of a small hydraulic diameter in condenser flow paths. The prior art recognized that greater internal surface area (or a reduced hydraulic diameter) on the refrigerant side of the tube would enhance heat transfer.

Mr. Saperstein testified that the heat transfer advantages of reducing hydraulic diameter were known to be limited because the resistance to the flow of vapor and condensate (often described as "refrigerant-side pressure drop") could become so substantial in the long serpentine tubes of conventional condensers as to choke the system if the flow path size became too small. Tr. 164, 444.

Because the benefits of a smaller hydraulic diameter were known, the particular range of small hydraulic diameters selected by Modine was a matter of design choice. Although the Cat condenser's parallel flow condenser had an overall hydraulic diameter of 0.04822, the Cat had individual segments with hydraulic diameters within the ranges claimed by Modine in the '580 patent. Modine urged the examiner to use the overall hydraulic diameter of the Cat instead of individual measurements. Modine had measured individual hydraulic diameters for the Cat in the range of 0.0382-0.0448 inch. Child application, Showa Ex. 5 at 277. A prior art disclosure of any numerical value within a claimed range teaches the entire range for purposes of obviousness under § 103. In re Wertheim, supra, 541 F.2d at 267, 191 U.S.P.Q. at 100 (C.C.P.A. 1976).

Prior art disclosing parallel flow and multi-circuiting

A number of prior art references taught the use of parallel flow in a condenser prior to 1985. Tr. 1244-46. The Cat condenser and the Uehara '268 patent taught parallel flow. Hitachi reference 49-114145 (Showa Phys. Ex. J, Tab 1) taught "a vertical-type condenser having a multiplicity of finned tubes arranged in parallel between an upper header and a lower header" (p. 201). U.S. Patent 1,958,226 to Askin, issued in 1934 (Showa Phys. Ex. J, Tab 4), taught headers containing slots "through which the tube ends engage in parallel rows, each row containing a plurality of tubes." Col. 1, ll. 45-48. Japanese Utility Model 57-66389 to Mitsubishi Heavy Industries (Showa Phys. Ex. J, Tab 2) taught a plurality of heat conducting tubes arranged in parallel between headers in a heat exchanger. It referred to an automotive air-conditioning heat exchanger such as a condenser (p. 3), and disclosed that parallel flow would result in less refrigerant pressure drop.

Prior art disclosing the advantages of a smaller condenser

The Mitsubishi prior art reference taught that the parallel flow arrangement allows tubes to be "so shortened as to reduce the (liquid) flow resistance and render smaller the size of the heat exchanger." Showa Phys. Ex. J, Tab 2, p. 4. The patent also taught a corrugated partition brazed to the inner surfaces of the tube (p. 3), of a type that would form crevices. And it taught the use of serpentine external fins. Webb Tr. 1245. Japanese Laid-open Utility Model 55-100963 to Clarion (Showa Phys. Ex. J, Tab 3) disclosed a small-sized condenser suitable for use in a relatively small space such as of a motor vehicle (p. 309) with condensing tubes in parallel (p. 303). It also taught the advantages of multiple short parallel tubes over a serpentine tube design. Figs. 1 and 3 and pp. 303-06.

Prior art teaching sawteeth and the effects of crevices

Internal sawteeth were used in the flow paths of condensers before 1985. Their use in a flow path reduced the hydraulic diameter of the flow path. In 1954, when Professor Gregorig was writing about sawtoothed flow paths in condensers, some people understood that sawteeth added surface area, thus increasing heat transfer. Marto Tr. 768.

Some people thought that there were possible heat transfer advantages from the surface tension "Gregorig effect" in sawtoothed condensers. Marto Tr. 761-763. The Uehara '268 patent taught the surface tension effects resulting from crevices.

Some of the prior art merely recognized that sawteeth enhanced heat transfer without knowing or saying why this occurred. Marto Tr. 768-69; Marto dep. 1, Showa Phys. Ex. H at 170.

In the 1970's, Hitachi developed a round tube with internal microgrooves resembling sawteeth that it patented in 1977. Showa Phys. Ex. J, Tab 25. By 1985, that sawtoothed condenser tube had become the industry standard in residential air-conditioning evaporators and condensers. Tr. 1237.

The prior art taught the use of internal sawteeth in flat automobile condenser tubes containing vertical partitions. Tr. 1236-1240. Nippondenso reference 59-13877 (Showa Phys. Ex. J, Tab 8) taught internal sawteeth in a flow path having a hydraulic diameter of approximately 0.024-0.032 inch. Showa Ex. 28; Webb Tr. 1240-42. Mitsubishi reference 58-169386 (Showa Phys. Ex. J, Tab 21) taught prior art tubes containing sawteeth. Mitsubishi reference 58-184 (Showa Phys. Ex. J, Tab 13) taught internal sawteeth for an air conditioner. Mitsubishi reference 59-110435 (Showa Phys. Ex. J, Tab 14) taught internal sawteeth for car air conditioners. (pp. 1-2.)

THE DIFFERENCES BETWEEN THE CLAIMS AND THE PRIOR ART

All of the elements of claims 9 and 10 are found in the prior art, but no single prior art reference predating the Grandparent application contains all the elements of claims 9 and 10. Several of the references lack only one or two of the elements of claims 9 and 10, and when combined with one other reference, teach all the elements of those claims.

For example, Oohara (Showa Phys. Ex. J, Tab. 32) taught all of the structural features of claims 9 and 10 except parallel flow. Parallel flow was taught by many references, including the Cat condenser, Yoko (Showa Phys. Ex. J, Tab 30), Askin (id., Tab 4), Mitsubishi Heavy Industries '389 (id., Tab 2), Hitachi reference 49-114145 (id., Tab 1), and Uehara (id., Tab 9).

The Mitsubishi '389 reference (id., Tab 2) discloses all the elements of claims 9 and 10 except the relatively small hydraulic diameter of the flow paths, and the presence of crevices. Those elements are taught by Uehara (id., Tab 9). Small hydraulic diameter is also taught by the Cat condenser, and Nippondenso 59-13877 (id., Tab 8). Crevices are also taught by the Hisaka reference (id., Tab 17) and the 1985 Handbook of Heat Transfer Applications (id., Tab 18).

With the exception of an overall hydraulic diameter with an upper limit of 0.040 inch, all of the limitations in claims 9 and 10 were found in the conventional automotive condensers and radiators in 1985 combined with elements found in the prior art Cat condenser, the most relevant prior art.

The prior art taught why these elements should be used to obtain a smaller, more efficient condenser. Most of the elements in claims 9 and 10 already were combined in the Cat condenser. The Cat condenser contained parallel straight tubes arranged between headers (Tr. 228), a sinusoidal

insert brazed to the tube wall (Tr. 229), crevices (Tr. 429), and a relatively small "overall" hydraulic diameter of .04822 inch.

The elements of claims 9 and 10 not found in the Cat condenser were an overall hydraulic diameter with an upper limit of 0.040 inch, discrete flow paths, complete bonding of an insert to the inside wall of the tube, and serpentine fins on the air side of the tube. Discrete flow paths, inserts solidly bonded to the interior of the tube wall, and serpentine air fins were standard components of aluminum automotive condensers in 1985. The question is whether it would have been obvious for one of ordinary skill in the art in 1985 who wanted to design a smaller condenser to combine the elements of the Cat condenser that were known to enhance heat transfer with the elements in the standard automotive condensers and radiators that also were known to enhance heat transfer, and to eliminate the unwanted elements of the Cat condenser.

The Cat condenser, which was a parallel flow condenser, taught the reduction of the hydraulic diameter of some flow paths below 0.040 inch and the use of an insert in the condenser tube. When the prior art teaches a numerical value within a range that is claimed in a patent, this will render the entire claimed range obvious. Wertheim, supra, 541 F.2d at 267. It was possible before 1985 to make an individual flow path with a hydraulic diameter of 0.040 or below, because Modine had done so already in the prior art Cat condenser. Mr. Saperstein testified that by 1985, small flow paths could be made by using inserts to subdivide the interior of the tube. One difficulty encountered was in preventing the refrigerant in one flow path from leaking into another flow path. Mr. Saperstein testified to the effect that there were brazing methods that could correct this problem before 1985, although

they were expensive or not commercially feasible for other reasons. Tr. 356-364.

It was known before 1985 that using an insert would increase the surface area in the flow paths and that this would enhance heat transfer in a parallel flow condenser. It had been recognized that "[h]eat transfer through a tube wall is proportional to the amount of internal surface inside the tube." Showa Phys. Ex. A-12 at M011264.

The Cat condenser was designed as a steel condenser with plate air fins to meet Caterpillar's particular needs for a condenser in existing earth-moving equipment, but steel was known not to be a good conductor of heat, and the plate air fins offered no advantages relating to heat transfer. Saperstein Tr. 228, dep. at Showa Phys. Ex. C, pp. 43-44, 47-48.

It would have been obvious to one with ordinary skill in the art in 1985 to use aluminum in a condenser rather than steel, if there were no compelling reason to use steel. It would have been obvious to such a person to place an insert inside the condenser tube to make smaller flow paths to increase heat transfer. It would have been obvious to such a person to make flow paths as small as some of the individual flow paths measured in the Cat condenser. It would have been obvious to such a person to make discrete flow paths so that refrigerant would not leak into an adjoining flow path. Such a person would have known that the use of many discrete flow paths in a parallel flow condenser would limit refrigerant-side pressure drop. Such a person would have known that inserts could be bonded to the wall of the tube by brazing, although it might be costly. Such a person would have known that an insert completely bonded to the tube wall would improve performance by increasing the surface area for heat transfer. It would have been obvious to such a person

that complete bonding of the insert to the tube would not be possible using the plate fins in the Cat condenser. It would have been obvious to such a person that the plate air fins of the Cat offered no heat transfer benefits and there was no reason to use them in any condenser other than the Cat. Common sense would teach such a person to discard the plate air fins of the Cat that were preventing the inserts inside the tube from being bonded to the wall by brazing. It would have been obvious to such a person to replace these plate fins with serpentine air fins.

It would have been more than "obvious to try" for such a person to use all of the elements of the Cat condenser that gave a known heat transfer benefit, and to discard those that did not. The incentive to do this would have been to make a smaller condenser that transferred heat as well as a larger one. What would such a person use to replace the discarded elements? The well known elements of conventional automotive condenser technology whose heat-transfer advantages had been proven. Such a person would have had more than a reasonable expectation of success. See In re Vaeck, 947 F.2d 488, 493, 20 U.S.P.Q.2d 1438, 1442 (Fed. Cir. 1991).

The resulting condenser would not have been a combination of randomly selected elements from prior art references in the field of heat exchangers, but a combination of one strong recent prior art reference (the Cat condenser), without the inappropriate features compelled by the existing design of the Cat earth-moving equipment, with what one with ordinary skill in the art would turn to first: common technology known by everyone in the same industry and long proven to be successful in conventional condensers.

The hypothetical person with ordinary skill in the art is deemed to have knowledge of all pertinent prior art and of all prior art solutions for a

common problem. In re Nilssen, 851 F.2d 1401, 1403, 7 U.S.P.Q.2d 1500, 1502 (Fed. Cir. 1988).

It is irrelevant that at the time the Cat condenser was made neither Modine nor any other company had disclosed a way to make the required small flow paths at reasonable cost. A way to make tubes and inserts at a reasonable cost was disclosed in the '311 process patent. Novelty in the process for making a product does not impart novelty or nonobviousness to the product made. "Rather, it is the product itself which must be new and unobvious." In re Pilkington, 411 F.2d 1345, 162 U.S.P.Q. 145 (C.C.P.A. 1969). In this case, the condenser of claims 9 and 10 is not patentably distinguishable from the prior art.

The Federal Circuit has indicated that a patent should be found invalid when "there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination." Brantingson Fishing Equip. Co. v. Shimano American Corp., 8 U.S.P.Q.2d 1669, 1672 (Fed. Cir. 1988) (emphasis added). Whenever, taken as a whole, the prior art contains some teaching, suggestion, or incentive supporting a combination of elements, an invention combining old elements will be obvious. In re Gorman, 933 F.2d 982, 986, 18 U.S.P.Q.2d 1885, 1888 (Fed. Cir. 1991) (emphasis added). An invention can be found to be obvious without a specific teaching in a single prior art reference that would lead an inventor to combine the teachings therein with another piece of prior art. In re Oetiker, 977 F.2d 1443, 1448, 24 U.S.P.Q.2d 1443, 1446 (Fed. Cir. 1992).

In this case, one with ordinary skill in the art knew in 1985 that a combination of the elements of claims 9 was desirable because there was a need for a smaller and lighter condenser, there was an incentive to make a smaller

and lighter condenser because of recent legislation, and the industry already was capable of making the small flow paths that were required. Modine already had made small flow paths in the Cat condenser. Modine could not make them well and at the same time at a reasonable cost until it used the process disclosed in the '311 patent.

All of the individual elements of claim 9 had been combined with other elements of claim 9 in various prior art references, although not in one piece of prior art. It was known that each of these elements could be combined with other elements in claims 9 in ways that would enhance heat transfer. The need for a smaller condenser that would transfer as much heat as a large one was the incentive to combine all of these elements in a way that would enhance heat transfer. Ways to combine these elements to enhance heat transfer were known. For example, one with ordinary skill in the art in 1985 knew that one way to compensate for a reduction in hydraulic diameter of a flow path that caused refrigerant-side pressure drop was by putting in another small flow path to limit refrigerant-side pressure drop.

Respondents have proved by clear and convincing evidence that claims 9 and 10 are invalid for obviousness under Section 103.

SECONDARY CONSIDERATIONS

Evidence of secondary considerations must be "carefully appraised in relation to the facts of the actual case in which it is offered." Cable Elec. Products, Inc. v. Genmark, Inc., 770 F.2d 1015, 1026, 226 U.S.P.Q. 881, 887 (Fed. Cir. 1985). The secondary evidence in this particular case does not overcome the prima facie showing made by respondents that claims 9 and 10 are invalid for obviousness under Section 103.

Modine offered evidence relating to a long-felt need for the invention that others had failed to meet, the unexpected nature of the benefits of the invention, and the commercial success of the invention.

LONG-FELT NEED

The issue here is whether the parallel flow condenser of the '580 patent "satisfied a long-felt need, or solved problems where others had failed." Sjolund v. Musland, 847 F.2d 1573, 1582, 6 U.S.P.Q.2d 2020, 2028.

People with environmental or fuel conservation concerns about heavy automobiles that consume large amounts of fuel may have a long-felt desire for a smaller lighter automobile, but the record does not show that there has been a demand for a smaller lighter condenser in an automobile. Both Modine and Showa tried to develop a parallel flow condenser with small flow paths in the 1970's just because of the age of their existing serpentine condensers, not because of any pressing need for a smaller lighter condenser or because of any consumer demand. Mr. Saperstein testified that he thought the serpentine condenser, after being used for about 30 years, was mature and soon would be obsolete. This was why Modine decided to design a new condenser. Showa Phys. Ex. C at 103-05; 40-42; Saperstein Tr. 161-63. Showa also had expected that the serpentine condenser would become obsolete. Tr. 1063-64. There was no customer demand for a new condenser. Suzuki dep., Modine Phys. Ex. J at 100-102, Hoshino dep., Modine Phys. Ex. C at 85-87.

Perhaps the legislation requiring that different refrigerants be used after 1995 might make all existing condensers obsolete by 1995. There may have been little incentive to make any new condenser until the new refrigerants were identified. The old serpentine condensers worked well. On the other hand, both Modine and Showa have been aware that a smaller, lighter

and more efficient condenser would be desirable for another reason: legislation has required the conservation of energy by producing more fuel-efficient automobiles. Saperstein Tr. 155-159. There was no long-felt need for a smaller condenser other than the indirect need of the automobile industry to conserve fuel.

Both Modine and Showa had suspended their development work on a parallel flow condenser during the 1970's because of fabrication difficulties that prevented small tubes from being built at a reasonable cost. By 1985, Modine had a parallel flow condenser and was using multi-circuiting in its Cat condenser. Some of the hydraulic diameters of the Cat flow paths were within the range claimed in the '580 patent. By 1985, the only problem left to solve in the parallel condenser was the high cost of fabrication of tubes with small hydraulic diameters. Showa Ex. 5 at 520; Showa Phys. Ex. F-94 at M52862; Dudley dep., Showa Phys. Ex. E at 100-01; Guntly dep., Showa Phys. Ex. A at 139-40. At that time tubes with small enough holes could not be extruded. When inserts were put in the tubes to make small flow paths, it was difficult to make them free-flowing because of brazing problems. Showa Ex. 5 at 520; Showa Phys. Ex. F-94 at M052862; Guntly dep., Showa Phys. Ex. A at 144. There also were problems in bonding the inserts to the walls of the tubes. Saperstein Tr. 113; Modine Ex. 14-G at M57428; Saperstein dep., Showa Phys. Ex. C at 106-07; Showa Phys. Ex. C-64 at M005615; Modine Ex. 14-G at M057428; Saperstein Tr. 358-59. And the bonding of the tubes to the headers leaked. Saperstein Tr. 337, 338; Saperstein dep., Showa Phys. Ex. C at 106-07; Showa Ex. 5 at 520; Showa Phys. Ex. F-94, at M52862; Showa Phys. Ex. E at 102; Dudley dep., Showa Phys. Ex. E at 103-05. There were expensive solutions to the brazing problems, and the small flow paths could be made. Saperstein Tr.

356-359. Modine finally solved the bonding problem by using the inexpensive Nocolok brazing process. Saperstein dep., Showa Phys. Ex. C at 141, 148. The Nocolok process made it possible to bond spacers in small tubes. Modine Ex. 14-G at M057428; Showa Phys. Ex. C-64. Nocolok produced tight tube-to-header joints. Showa Ex. 5 at 521; Showa Phys. Ex. F-94 at M052864. By September 1986, Modine was using the Nocolok brazing process to make small holes in a parallel flow condenser at a reasonable cost. Marto Tr. 826-27, 766-767. Guntly dep., Showa Phys. Ex. A at 244-45; Showa Phys. Ex. H-122 at M87004; Showa Phys. Ex. H-123.

The '580 patent did not solve the problem of fabricating smaller tubes at a reasonable cost; it merely patented the condenser in which this had been done and disclosed how it was done by referring to Modine's '311 process patent. The '311 process patent was filed at about the same time as the '580 patent application. Once the '311 patent taught a means to fabricate smaller tubes at a reasonable cost, Modine could make condensers with smaller tubes at a reasonable cost, but so could anyone else using the '311 process patent. In Calmar, Inc. v. Cook Chemical Co., 383 U.S. 1, 36, 148 USPQ 459 (1966), the Supreme Court found that the insecticide industry had a long-felt need for a mechanical closure on a spraying device. The mechanical closure problem was solved by another patent involving pouring spouts for liquid containers. The Supreme Court held that the long-felt need of the insecticide industry for a solution to a mechanical closure problem would not support patentability of the insecticide patent when the mechanical closure problem had been solved by an invention in another patent. 148 USPQ at 474.

In this case, if there had been a long-felt industry need for a way to make small flow paths at a reasonable cost, the need was met by processes

disclosed in other patents. These processes are disclosed in Modine's '311 and '385 patents and only incorporated by reference in the '580 patent. Showa Ex. 2, Col. 3 and 4. The '311 patent (disclosing a new method of tube and spacer construction) and the '385 patent (a method for bonding the tube and header) made it possible for Modine to manufacture small light condensers at a reasonable cost using the known Nocolok brazing process. See Avant, Inc. v. Polaroid Corp., 572 F.2d 889, 891-92, 197 U.S.P.Q. 593, 595 (1st Cir.), cert. denied, 439 U.S. 837 (1978).

Modine designed a successful parallel flow condenser in the 1980's when it was able to fabricate inexpensive small flow paths in condenser tubes. Showa Ex. 5 at 520-21. The '311 patent was incorporated by reference in Modine's '580 patent only to show a "preferred means by which the tubes 20 with accompanying spacers 40 may be formed." Showa Ex. 2, col. 4, 11. 35-36.

Meanwhile, Showa was developing its own techniques to make a smaller lighter condenser with tubes having a small hydraulic diameter.

A contemporaneous independent invention shows that at least two people have been trying to solve the same problem, and that they succeeded at about the same time. The very fact that two companies develop a different solution to the same problem, as they did here, at about the same time suggests that there was no need that others were unable to meet at that particular time.

The Federal Circuit has held that contemporaneous independent invention is an indication of the level of knowledge in the art at the time the invention was made, and supports a finding of obviousness. In re Merck & Co., Inc., 800 F.2d 1091, 1098, 231 U.S.P.Q. 375, 380 (Fed. Cir. 1986).

Showa developed its SC condenser at about the same time that Modine developed its PF condenser. Both companies developed condensers that were

smaller and lighter than their serpentine condensers, yet could be made at a reasonable cost. In the late 1960's Showa manufactured serpentine condensers that had extruded flat tubes with inner fins and interior partitions that created discrete flow paths. Okamoto Tr. 1031-1032; Showa Ex. 41. The partitions and inner fins increased the heat transfer area inside the tubes. Okamoto Tr. 1057-58. The partitions also strengthened the condenser tube so that it could withstand internal pressure from the hot refrigerant. Tr. 1057. In the 1970's and early 1980's, Showa made condenser tubes with various types of internal fins, including sawtoothed fins, to increase the interior surface area. Tr. 1058; Modine Phys. Ex. C-4 at SH10000430-429 (Japanese Design Announcements, laid open in 1981); Modine Phys. Ex. C-4 at SH10000428-427; Modine Phys. Ex. C-6; Showa Ex. 36.

In 1972, Showa manufactured a vertical parallel flow condenser for Hitachi Limited. Okamoto Tr. 1061-62; Suzuki dep., Modine Phys. Ex. J at 96-98. This condenser, the subject of 1972 Japanese patent 49-114145, Showa Phys. Ex. J, Tab 1, had headers connected by multiple parallel extruded tubes, through which the refrigerant flowed from top to bottom. Okamoto Tr. 1061-1062. Each tube had a single triangular internal "tooth" at the top and bottom of its flow path. Showa Ex. 60; Okamoto dep., Modine Phys. Ex. G at 4-5. Due to the high cost of these tubes and difficulty in bonding the tubes to headers, Showa stopped making this condenser after about a year. Suzuki dep., Modine Phys. Ex. J at 68; Okamoto dep., Modine Phys. Ex. G at 9-11.

In 1980, Showa began to develop a new parallel flow condenser. Okamoto Tr. 1063-64. Showa built and tested several parallel flow condensers in the early 1980's. Modine Phys. Ex. C-5; Showa Ex. 42; Okamoto Tr. 1065; Modine Phys. Ex. C-19 at SH10000562, 566; Sasaki dep., Modine Phys. Ex. H at 68-71;

Suzuki dep., Modine Phys. Ex. J at 57-73, 74-75, 99-100; Hoshino dep., Modine Phys. Ex. C at 67-74, 93-94. After these tests, Showa designed a smaller and lighter condenser. Okamoto Tr. 1065; Showa Ex. 54. The new condenser contained parallel tubes between headers. It had the same core frontal area as the serpentine condenser but half the thickness of the condenser core. Showa expected the thinning of the core to result in a loss of heat transfer. To compensate for this, Showa reduced the pitch (distance between corners) and height of the air fins. Reducing the pitch and height of the air fins would increase air-side pressure drop. To compensate for this, Showa reduced the thickness of the air-side fins and made the tube smaller. Okamoto Tr. 1066; Hoshino dep., Modine Phys. Ex. C at 175; Modine Phys. Ex. C-19 at SH10000583. To compensate for the decrease in surface area inside the tube because of the smaller tube size, Showa added sawtoothed fins around the inside wall of the tube and partitions. Okamoto Tr. 1067; Modine Phys. Ex. C-19 at SH10000583. Showa also added to the number of circuits in the condenser to limit refrigerant-side pressure drop. Okamoto Tr. 1067; Hoshino dep., Modine Phys. Ex. C at 175. By February 1986, Showa had completed the design of its new condenser, called the SC or super compact condenser. Modine Phys. Ex. C-19 at SH10000581. By June 10, 1986, Showa had tested a prototype. Okamoto Tr. 1069, 1070-71; Modine Phys. Ex. G-3. The prototype used flat, rectangular extruded tubes with three flow paths with sawtoothed inner fins on the interior walls. Okamoto Tr. 1072; Modine Phys. Ex. C-19 at SH10000583. The heat transfer performance of the new condenser was comparable to that of the serpentine condenser, but the new condenser had lower refrigerant-side pressure drop and 38% less weight. Modine Phys. Ex. G-3. Later, the tubes were made smaller and changed in shape from rectangular to rounded at the

corners that were exposed to air to reduce air-side pressure drop. Okamoto Tr. 1077; Hoshino dep., Modine Phys. Ex. C at 221-222; Showa Ex. 45. Initially Showa had difficulty obtaining a tube-to-header bond that did not leak, and it had a problem extruding a tube with a small height that had sawteeth around the entire perimeter. Okamoto Tr. 1072-75. Showa solved the bonding problem [

confidential business information deleted

] Showa began to market the SC condenser in July, 1986. Modine Phys. Ex. C-14 at SH10000618-608. In September 1986, Showa brought a sample of its new condenser to Modine and proposed a joint manufacturing venture. Okamoto Tr. 1080-82; Showa Ex. 39 at SH10000818-820 (pp. 12-14 of translation). Modine declined the offer, saying it was developing a similar product. Showa Ex. 39 at SH10000818-820. Mr. Okamoto testified that Showa did not become aware of any of the features of Modine's PF condenser until February 1987, when Modine publicly introduced the condenser at a trade show. Okamoto Tr. 1082.

Showa argues that it independently designed its SC condenser. Modine offered no evidence to support its suggestion that Showa obtained information from Honda about Modine's condenser in January 1986, one month before Showa made its drawings for the SC condenser. Showa has offered testimony and produced documentary evidence of its progress in developing a parallel condenser before it saw Modine's designs. It is found that Showa independently developed its own SC condenser.

Showa's independent development of the SC condenser at about the same time that Modine developed its PF condenser lends support to a finding that claims 9 and 10 of the '580 patent were invalid for obviousness. See Merck, 800 F.2d at 1098, 231 U.S.P.Q. at 380; In re Farrenkopf, 713 F.2d 714, 719-20, 219 U.S.P.Q. 1, 6 (Fed. Cir. 1983); Concrete Appliances Co. v. Gomery, 269 U.S. 177, 185 (1925).

Long-felt need under the circumstances of this case does not support a finding of non-obviousness.

UNEXPECTED BENEFITS

To show that the invention had unexpected benefits, Modine must offer objective evidence of the superior performance of its invention as claimed in claims 9 and 10 over the closest prior art reference, and evidence that one skilled in the art would not have expected this improvement in performance. In re De Blauwe, 736 F.2d 699, 705, 222 U.S.P.Q. 191, 196 (Fed. Cir. 1984). Modine did not offer this kind of evidence.

The comparison must be made between the invention and the closest prior art. In re Johnson, 747 F.2d 1456, 1461, 223 U.S.P.Q. 1260, 1263 (Fed. Cir. 1984). Comparisons between the invention and other prior art do not prove unexpected benefits. In re Wood, 599 F.2d 1032, 1037, 202 U.S.P.Q. 171, 174 (C.C.P.A. 1979). The closest prior art is that which shares the most claim limitations with the invention. In re Merchant, 575 F.2d 865, 869, 197 U.S.P.Q. 785, 787-88 (C.C.P.A. 1978).

In this case, the closest prior art to the condenser of claims 9 and 10 is the Cat condenser. The Cat, unlike the serpentine condenser, has:

(1) "straight tubes," Modine Phys. Ex. YY; compare Showa Ex. 2, col. 12, l. 3;

(2) arranged parallel to each other, Saperstein Tr. 387; compare Showa Ex. 2, col. 12, ll. 5, 10;

(3) a corrugated insert inside the tubes that conducts heat, Saperstein Tr. 387-88; compare Showa Ex. 2, col. 12, ll. 19-20;

(4) a hydraulic diameter of 0.048 inch, Showa Ex. 5 at 452, compared with 0.079 for the smallest flow path in a serpentine condenser, Showa Ex. 2, col. 9, l. 37 (Table One); compare Showa Ex. 2, col. 12, ll. 20-21;

(5) crevices, Saperstein Tr. 429; Saperstein dep., Showa Phys. Ex. C. at 296; compare Showa Ex. 2, col. 12, l. 30; and

(6) at least some crevices extending generally along the length of the associated flow paths, see Saperstein Tr. 571 (crevices of this sort "occasionally" occur in Cat condenser); Showa Phys. Ex. C-62 at M60740 (flow paths on left-hand side); compare Showa Ex. 2, col. 12, ll. 30-31.

The PF condenser practices claims 9 and 10 of the patent and it performs better than the Cat condenser, but this was predictable. Modine told the examiner some of the features that made the PF condenser transfer heat more efficiently than the Cat condenser, and said that these advantages were unexpected. Showa Ex. 5 at 363. These advantages would not have been unexpected by those with ordinary skill in the art.

For two reasons unrelated to the elements of claims 9 and 10, one with ordinary skill in the art in 1985 would have expected the PF condenser to outperform the Cat condenser.

1. Steel material: The Cat was made of steel while the PF condenser is made of aluminum. Steel has only one-quarter the thermal conductivity of aluminum. Yamamoto Tr. 1175. It was not unexpected that the aluminum PF condenser would transfer heat better than the steel Cat. Marto Tr. 841, 846-47. It was not unexpected that the PF condenser would be lighter than the Cat, because steel is heavier than aluminum. In the same design, a steel condenser would have to be larger than an aluminum condenser because of

steel's poor heat conductivity. Tr. 1175. A person with ordinary skill in the art would have expected a condenser made of aluminum to be lighter and smaller and to transfer heat better than a steel condenser.

2. Louvered air fins: The Cat condenser did not use louvered air fins while the PF condenser did. Guntly dep., Showa Phys. Ex. A at 857. (Louvers are small projecting slots in fins that look like half-opened venetian blinds.) It was known by 1985 that louvered fins transferred heat on the air side of the tube better than the flat plate fins used in the Cat condenser. See Guntly dep., Showa Phys. Ex. A at 245-46, 857-58, 874-75; Yamamoto Tr. 1174-75. Louvered fins were common in condensers and other heat exchangers before 1985. Id. at 394; see Guntly dep., Showa Phys. Ex. A at 157-58 & Showa Phys. Ex. A-12 at M011265. Plate fins were used in the Cat because that condenser was designed to fit into a module with other existing parts of the Caterpillar heat exchanger system. Showa Ex. 5 at 520. One with ordinary skill in the art would have expected a condenser with louvered air fins to transfer heat better than the plate fins on the Cat. These benefits were not unexpected and they could not be attributed to claims 9 and 10.

There were two other reasons that the PF condenser outperformed the Cat condenser that are related to elements in claim 9:

... The insert was solidly attached to the tube wall: The insert in the Cat condenser tube was not completely brazed to the tube wall throughout the tube. Claim 9 requires web means joined to the flat side walls. Because of the way the Cat condenser was manufactured, it was difficult to obtain complete brazing. The importance of complete bonding of the tube insert to the wall in enhancing heat transfer would have been recognized by one with ordinary skill in the art and was not an unexpected benefit. See p. 50 above.

Smaller free flow area inside the tube: The Cat condenser's free flow area inside the tube was about twice that of the PF. Showa Ex. 5 at 452. The smaller overall hydraulic diameter in the parallel flow condenser required by claim 9 results in a smaller free flow area in the PF condenser than in the Cat. It was known before 1985 that reducing the free flow area (within limits) would contribute to better heat transfer under certain conditions. Yamamoto Tr. 1175; Marto Tr. 637-41; Showa Phys. Ex. A-12 at M011264. To one with ordinary skill in the art this would not have been unexpected.

In addition to benefits that would not have been unexpected, the '580 patent suggests that the invention had certain unexpected benefits over the prior art when either these benefits were exaggerated or there was no evidence that these benefits existed.

. The patent states:

> a condenser made according to the invention utilizing all three facets thereof, i.e., small hydraulic diameter, at least one elongated crevice, and the presence of microcracks or channels[,] unexpectedly achieves a considerable increase in efficiency.

Col. 9, 11. 49-54.

During the prosecution of the patent, Modine relied on Figure 5 to show unexpected benefits associated with decreasing hydraulic diameter. Figure 5 exaggerates the advantages of a smaller hydraulic diameter in the invention as compared to its own existing condensers.

On the right side, Figure 5 shows the predicted heat transfer performance of "production condenser" cores made by Modine, and on the left, the predicted heat transfer performance of the '580 invention, as the size of the hydraulic diameter changes. Showa Ex. 2, col. 2, 11. 54-58 and Fig. 5. The left side of Figure 5 was based only on Modine's one-circuit serpentine condenser; it did not include Modine's two-circuit serpentine condenser. See Guntly Tr.

975-76. The two-circuit serpentine condenser had a smaller hydraulic diameter than the other Modine serpentine condensers, contained an additional circuit, and was more efficient than the one-circuit serpentine condenser. See Saperstein Tr. 249; Table 1 of Figure 6 of the patent, which compares the invention to the two-circuit serpentine condenser, and Saperstein Tr. 245-46. Figures 5 and 6 were based on the same test conditions. Guntly Tr. 974-75; Showa Ex. 2, col. 7, ll. 54-57; col. 8, ll. 18-22. In other words, in Figure 5 Modine compared the invention to its own one-circuit serpentine condenser rather than to its own two-circuit serpentine condenser that performed better. The '580 patent did not say that all of Modine's production condensers were included in Figure 5, but it was unfair for Modine to compare its invention to one of its own prior art condensers that did not perform as well as one of its other prior art condensers.

Figure 5 shows that the reduction of the hydraulic diameter in prior art condensers caused reduced heat transfer. Mr. Guntly's original version of these curves, based on a computer model prepared using actual test data, reflected an increase in heat transfer. Tr. 980-81; Showa Phys. Ex. B-53 at M060430. Modine removed the original upward-sloping curve from the right side of Figure 5. See Showa Phys. Ex. A-32. Figure 5 therefore exaggerates the advantages of the invention of the '580 patent.

Benefits associated with decreasing sizes of hydraulic diameters in a certain range did exist, but these benefits were predicted in the theoretical literature. The inverse relationship between hydraulic diameter and heat transfer had been discussed in the published literature. See Marto Tr. 758-60; Yamamoto Tr. 1156-57.

Showa points out that this relationship could have been predicted by engineering equations in use in the early 1980's. See equations for calculating heat transfer used by Professor Marto (Showa Phys. Ex. H-126 at M060130-31) and Mr. Yamamoto (Showa Exs. 94 and 95; Yamamoto Tr. 1162-66; Webb Tr. 1251-55.) Any heat transfer benefits resulting from a reduction of hydraulic diameter would not have been unexpected based on engineering equations alone. But little weight is given to these engineering equations. Showa did not prove that one with ordinary skill in the art of designing condensers in 1985 would have been likely to rely upon these equations. When Modine wanted theoretical advice, it hired Dr. Marto as an expert.

Professor Carey testified persuasively that one using engineering equations alone could not have predicted accurately what would happen in any particular condenser when the hydraulic diameter was reduced. He testified that there might be a change from turbulent to laminar flow at some point in a small tube, although he had no idea at what point that might occur in the tubes tested. Tr. 1432-34. He also testified that he did not know what effect reductions of hydraulic diameter would have on changes in performance if there were a refrigerant side pressure drop. Tr. 1436-37. As a practical matter there might not be any heat transfer benefits resulting from a reduced hydraulic diameter within the range claimed by the '580 patent depending on other conditions present in the condenser.

Modine argued that there were two unexpected benefits from crevices. The first unexpected benefit was that crevices increase heat transfer unexpectedly compared to circular flow paths. Col. 5, 11. 49-50; col. 6, 11. 20-21.

The curves on the left side of Figure 5 (representing the condenser of the '580 patent which had crevices in small flow paths) were based on a

computer program containing an equation for predicting the heat transfer coefficient on the inside of the tube (where any benefits from crevices would appear). This equation was derived from tests using round tubes. Guntly Tr. 982-84, 997-98; Guntly dep., Showa Phys. Ex. A at 269; see Showa Phys. Ex. A-26. Round tubes do not have crevices. Saperstein Tr. 421. When Modine actually tested the PF condenser which had crevices, the results were within the range of experimental accuracy of those predicted using the computer program equation that was based on round tube data. Guntly Tr. 1001-02; Guntly dep., Showa Phys. Ex. A at 470. See Modine Exhibits 51 and 88, which used the same test conditions. Saperstein, Tr. 936-37. The same equations that predicted performance of the non-round tubes reported in Exhibit 51 also predicted the performance of the round tube, number 6 in Showa Ex. 94. See Showa Exs. 94 and 95; Yamamoto Tr. 1158.

The consistent results obtained for round tubes and tubes with crevices show no significant benefit from crevices in small flow paths. The tests show that round tubes and tubes with crevices in parallel flow condensers with small flow paths perform about the same in heat transfer. See Saperstein Tr. 456-463; compare Showa Ex. 88 at M062917-18 with Modine Ex. 52 at 1, 6-9, 16-17 (showing tubes labelled NPD-1134A1, 3E6036B and NPD-1145A4 were included in both tests); See Showa Ex. 88 at M062920-24.

Modine's statement in the '580 specification that in the condensers with crevices "the local heat transfer rate is dramatically increased over a circular passage with the same hydraulic diameter" is not supported by Modine's own tests. Showa Ex. 2, col. 6, ll. 20-22.

Benefits from crevices were not proved by Modine over the entire range of hydraulic diameter sizes claimed by Modine. As a practical matter, the vapor

shear force in a very small flow path may be strong enough to overcome the effects of surface tension forces resulting from crevices. See Showa Phys. Ex. H-122 at M87007, and Showa Phys. Ex. AA. Figure 5 and Modine Ex. 51 show no benefits from crevices in tubes with very small hydraulic diameter.

The second advantage that Modine said could be obtained from crevices was independence from gravity. The '580 patent suggests that the combination of crevices and small hydraulic diameters unexpectedly renders the "operation of the condenser independent of gravity, which is to say that it will operate successfully in virtually any attitude." Col. 6, ll. 33-38.

Modine showed that in certain embodiments of the invention, gravity had little effect on the condenser's performance. Modine made tests showing that its PF condenser (which had a hydraulic diameter of 0.029, in about the middle of the range claimed) operated almost identically in either the horizontal or the vertical position, with inlets at the top or bottom. Saperstein Tr. 426-26; Guntly dep., Showa Phys. Ex. A at 923-24; Costello dep., Showa Phys. Ex. F at 42.

In the test made on the condenser built by Modine that is described in the last two pages of Modine Ex. 51, the test showed that when the hydraulic diameter was larger than the 0.029 inch hydraulic diameter of the PF condenser, the condenser was affected by whether it had a vertical or horizontal orientation. Modine's own tests do not show "unexpected benefits" over the full claimed range of the invention.

In this case, Modine wants to show "independence of gravity" in condensers having hydraulic diameters larger than 0.029 inch, and as high as the 0.070 inch, the upper limit of the range covered by claims 9 and 10 according to complainant. To this end, Modine modified its definition of

"independence of gravity," arguing that independence from gravity is shown by a .7 or higher ratio between performance in a vertical orientation with the inlet at the top and performance in a horizontal orientation with the inlet still at the top. Comparison of performance with inlets always at the top does not test independence from gravity. To test the effect of gravity, one must include tests in which the inlet is at the bottom. Yamamoto Tr. 1173.

Respondents argued that the ability of a condenser to overcome the effects of gravity is related to the average free flow area per pass within the condenser, not to its internal crevices or the overall small hydraulic diameter of its flow paths. Showa Ex. 10 at 1-2; Yamamoto Tr. 1171-73. This argument was supported by the fact that the condenser least affected by its vertical or horizontal orientation was the prior art serpentine condenser. This had the largest hydraulic diameter of any condenser tested but the lowest average free flow area per pass (because it had only one circuit). See Showa Ex. 10 at 1. Independence of gravity was not an unexpected benefit of the invention of claims 9 and 10.

Complainant did not prove that the invention offered unexpected benefits.

COMMERCIAL SUCCESS

Proof of commercial success requires economic evidence that a product captured a substantial market share or achieved unusually high profitability per unit. See Cable Elec., 770 F.2d at 1026-27, 226 U.S.P.Q. at 888. Commercial success is a relative measurement whose purpose is to shed light on the relative performance of the asserted invention, apart from other market forces or changes in the industry. See Vandenberg v. Dairy Equipment Co., 740 F.2d 1560, 1567, 224 U.S.P.Q. 195, 199 (Fed. Cir. 1984); cf. American

Standard, Inc. v. Pfizer Inc., 828 F.2d 734, 742, 3 U.S.P.Q.2d 1817, 1821 (Fed. Cir. 1987).

To prove commercial success, Modine relies principally on raw sales figures. Modine Ex. 7, 8; Pavlick Tr. 586-87. Modine did not show the market share of the PF condenser or its profitability per unit, nor did it compare sales of the PF condenser with sales of its own prior art condensers. In Vandenberg, 740 F.2d at 1567, 224 U.S.P.Q. at 199, the court refused to rely upon evidence of raw dollar sales because the patentee had "failed to show how sales of the patented device compared to sales of their previous model, or what percentage of the market their new model commanded".

[

confidential business information deleted

]. When the patentee "was clearly the market leader before the introduction of [the invention], its sales figures cannot be given controlling weight in determining the effect of commercial success ... on the question of obviousness." Pentec, Inc. v. Graphic Controls Corp., 776 F.2d 309, 316, 227 U.S.P.Q. 766, 770 (Fed. Cir. 1985).

Modine offered no proof that any commercial success of condensers practicing claims 9 and 10 could be attributed to the combination of the elements found in those claims. See Baxter Travenol, 952 F.2d at 392, 21 U.S.P.Q. at 1285. It is likely that Modine has been successful in selling the PF condensers because they were the model available from Modine to replace Modine's serpentine condensers. There probably were customers who were pleased to see the new model because it was smaller and lighter than the serpentine condenser and performed about as well, but there was no evidence even of this.

The combination of the elements required in claims 9 and 10 of the '580 patent would have been obvious to one with ordinary skill in the pertinent art in 1985. The fabrication techniques for making the condenser of claims 9 and 10 were not obvious, but they are patented in the '311 patent, and will not support the patentability of the '580 patent. It is found that secondary considerations do not overcome the prima facie evidence that claims 9 and 10 of the '580 patent are invalid for obviousness under Section 103.

ENFORCEABILITY

Applicants for patents and their representatives are required to conduct themselves with candor in their dealings with the PTO. 37 C.F.R. § 1.56. See Merck & Co.,Inc. v. Danbury Pharmacal, Inc., 873 F.2d 1418, 1420, 10 U.S.P.Q.2d 1682, 1685 (Fed. Cir. 1989). If the applicant learns that a misrepresentation has been made, he has an obligation to advise the examiner of the true facts. See Rohm & Haas Co. v. Crystal Chemical Co., 722 F.2d 1556, 1571-72, 220 U.S.P.Q. 289, 301 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984). The reason for this rule is that applications for patents are considered by the patent examiner in an ex parte proceeding. For much of the information that the examiner needs, he must rely upon what the applicant gives him. An applicant's failure to comply with this duty of candor can result in a finding that the patent is unenforceable due to inequitable conduct.

To prove inequitable conduct, the respondents must prove by clear and convincing evidence that the misrepresentation or the information withheld was material, and that the applicant intended to mislead the PTO. Scripps Clinic & Research Foundation v. Genentech, 927 F.2d 1565, 18 U.S.P.Q.2d 1001, 1015 Fed. Cir. 1991). Because direct proof of intent to deceive the examiner is

rarely available, intent may be inferred from evidence of the circumstances surrounding the conduct in issue. Merck, 873 F.2d at 1422, 10 U.S.P.Q.2d at 1686; LaBounty Mfg., Inc. v. U.S. Int'l Trade Comm'n, 958 F.2d 1066, 1076, 22 U.S.P.Q.2d 1025, 1026 (Fed. Cir. 1992).

A misrepresentation or failure to disclose is material when there is "a substantial likelihood that a reasonable examiner" would consider the misrepresentation or what is not disclosed important in deciding whether to allow the application to issue as a patent. See 37 C.F.R. Section 1.56(a).

If the misrepresented or withheld information is highly material, a lower showing of deceptive intent will establish inequitable conduct. American Hoist & Derrick Co. v. Sowa & Sons, 725 F.2d 1350, 1363 (Fed. Cir.), cert. denied, 469 U.S. 821 (1984).

FIGURE 5

1. Figure 5 of the '580 patent purports to show that the condenser disclosed in the '580 patent increased the transfer of heat when compared to Modine's own prior art condensers. In fact, Figure 5 understated the performance of Modine's prior art condensers. It did this by failing to include in Figure 5 the performance of a prior art condenser that performed better than the one with which the invention was compared.

Figure 5 misrepresents the performance of Modine's prior art condensers. Figure 5 shows that the performance of Modine's prior art condensers was generally lower than the performance of the invention. It shows that in the prior art condensers, heat transfer declines as the condenser's hydraulic diameter becomes smaller, but in the condenser of the '580 patent, there is an increase in performance as hydraulic diameter decreases. This contrast was

intended to show that there were significant and unexpected benefits associated with the invention. ('580 patent, Col. 7, lines 65-68.)

In fact, Figure 5 exaggerates the heat transfer advantage of the condenser of the '580 patent and misrepresents the performance of Modine's prior art condensers.

In Figures 6-8 of the patent Modine compared the '580 invention with the two-circuit serpentine condenser described in Table 1. In showing the heat-transfer performance of the prior art in Figure 5, however, Modine did not include the performance of the two-circuit serpentine condenser. Those data points were excluded even though Modine knew that the two-circuit serpentine condenser performed better than the one-circuit serpentine condenser. Saperstein Tr. 249. Had Modine included data for the two-circuit serpentine condenser, the prior art curves (marked B in Figure 5) would have been significantly higher. Leaving out the performance of the prior art two-circuit serpentine condenser that was comparable to the performance of the condenser of the '580 patent made the invention look as if it had substantial unexpected benefits that it did not have.

According to Table 1 of the '580 patent, Modine's two-circuit serpentine condenser had a relatively large hydraulic diameter of about 0.079 inch. The performance of this condenser is more consistent with the prior art curves that Mr. Guntly originally drew, based on a computer model he designed using actual test data. Showa Phys. Ex. B-53 at M060430. This original draft of Figure 5 contained a curve that was removed later. In the original draft, the prior art curves sloped upward, not downward, as hydraulic diameter decreased. Guntly Tr. 980-81.

The test data for the two-circuit serpentine condenser and Modine's computer predictions based on years of testing both indicated that heat transfer improved in the two-circuit serpentine condensers as hydraulic diameter decreased. Nevertheless, someone associated with Modine removed the upward-sloping curves from Figure 5 and left only downward-sloping curves as the hydraulic diameter decreased. Showa Phys. Ex. A-32. The removal of the upward-sloping curve is found to have been intentional.

It is found that misrepresentations were made in Figure 5 and certain material facts were not disclosed in Figure 5. The misrepresentations were relevant and supported the argument made by the applicant to the examiner that the invention had substantial unexpected benefits. Figure 5 was intended to show the unexpected benefits of a small hydraulic diameter in the condenser of the '580 patent. It is not clear how important Figure 5 was to the examiner. He never allowed any claims based solely on the small hydraulic diameter element of the invention, saying that the size of the hydraulic diameter was a matter of design choice, but he did allow claims 9 and 10. The advantages of a small hydraulic diameter over the prior art were the subject of the largest part of the prosecution history. The failure to disclose in Figure 5 that the effects of the invention were comparable to those in the prior art is found to be a material misrepresentation. See Merck, 873 F.2d at 1421-22, 10 U.S.P.Q.2d at 1686. An overly broad portrayal of test results has been found to reflect an intentional effort to deceive. Procter & Gamble Co. v. Kimberly-Clark Corp., 740 F. Supp. 1177, 1190, 1199, 12 U.S.P.Q.2d 1577, 1587, 1594 (D.S.C. 1989) aff'd without op., 907 F.2d 159 (Fed. Cir. 1990). It is therefore found that the misrepresentations that Modine made in Figure 5 were material as well as intentional.

2. Showa also accuses Modine of inequitable conduct in basing Figure 5 on an erroneous equation and not advising the examiner that the equation was erroneous after learning about the error. The evidence on this issue is not conclusive.

After filing the patent application Modine learned that the curves on the left side relating to the invention might be incorrect because an inaccurate equation may have been used. The curves on the left were based on a Modine computer program. Guntly Tr. 982. The heat transfer coefficient used in that program for measuring heat transfer on the inside of the condenser tubes was calculated based on an equation that Mr. Guntly had derived from tests he had performed in early 1985 on 208 round capillary tubes in a water-cooled condenser bundle. Id., Tr. 984. The results of that testing appear in a March 1985 report by Mr. Guntly, and the equation appears at page M100260 of Showa Phys. Ex. A-26. The only actual test points used in deriving the curves of Figure 5 were those of the prototype PF condensers having a hydraulic diameter of 0.029 inch. No condensers with larger or smaller hydraulic diameters were included. The curves, apart from the single test point for each air speed measured, reflected a prediction of results based on the formula in Mr. Guntly's equation for internal heat transfer coefficients. See Showa Phys. Ex. B-53 at M060430; see Guntly dep., Showa Phys. Ex. A at 380; Showa Ex. 2 at col. 7, ll. 45-48. This equation formed the basis for the curves on the left side of Figure 5 showing the effect of changes in hydraulic diameter on performance.

After preparing his March 1985 report, Mr. Guntly learned that one-third of the test data points measuring hydraulic diameter were in error because one-third of the tubes tested turned out to have a hydraulic diameter twice as

large as he had understood them to be when deriving the equation. Guntly Tr. 985; Guntly dep., Showa Phys. Ex. A at 268, 278. The equation was wrong in the critical area of the relationship between performance and hydraulic diameter. Guntly Tr. 985; Guntly dep., Showa Phys. Ex. A at 268.

At the hearing Mr. Guntly testified that he had corrected the equation on his own computer sometime before Figure 5 was drawn. Tr. 985. Although he had testified earlier at a deposition that he could not remember when he corrected the equation (Guntly dep., Showa Phys. Ex. A at 280), later in the same deposition, after being asked whether the correction was made before or after he first drew the graph that became Figure 5, Mr. Guntly testified that the correction was made in the weeks between the issuance of his March 1985 report identifying the new equation for internal heat transfer and his preparation on April 10, 1985 of the graph that became Figure 5. Guntly dep., Showa Phys. Ex. A at 381-82, 416, 508, 633.

On April 19, 1985 Russell Awe of Modine wrote a letter to Mr. VanSanten transmitting Mr. Guntly's April 10, 1985 draft of Figure 5 with a copy of the March 1985 Report No. 226 containing the erroneous formula. Showa Phys. Ex. A-26. Mr. Awe stated that Mr. Guntly's March 1985 report presents the equation used to develop Figure 5. Showa Phys. Ex. B-53 at 1; Guntly Tr. 986-87. Mr. Guntly received a carbon copy of this letter. Showa Phys. Ex. B-53 at 2. He did not tell either Mr. Awe or Mr. VanSanten that the equation given to Mr. VanSanten was not used to prepare Figure 5. Showa Phys. Ex. B at 47; Showa Phys. Ex. D at 30. Mr. Guntly never wrote a memorandum or supplementary report stating that the equation had been corrected. Guntly dep., Showa Phys. Ex. A at 385.

At the hearing Mr. Guntly again testified that Figure 5 was drawn based on a new equation. Tr. 985.

In September 1986, more than a year after Mr. Guntly drafted the graph that became Figure 5, Modine gave Professor Marto the backup test data for Mr. Guntly's March 1985 report. These data contained erroneous hydraulic diameter measurements and incorrect data points. Compare Showa Phys Ex. A-26 at M100272-77, with Showa Phys. Ex. A-42 at M87231-36; see Guntly Tr. 987-89. Mr. Guntly was at the meeting in which Professor Marto was given those materials, but he did not say that any measurements were wrong. Marto Tr. 827; Marto dep., Showa Phys. Ex. H at 164; Guntly Tr. 967-68. Later, Professor Marto and Mr. Guntly spoke several times about these test results, as Professor Marto derived a new equation for calculating the internal heat transfer coefficient from those test points and prepared a report. Marto Tr. 829; Marto dep., Showa Phys. Ex. H at 143-44; Guntly dep., Showa Phys. Ex. A at 721. Mr. Guntly still did not tell Professor Marto that the hydraulic diameters of one third of the data points in the test data were in error. Marto Tr. 834; Marto dep., Showa Phys. Ex. H at 164. Professor Marto made a report to Modine on March 16, 1987 on the test data. Showa Phys. Ex. H-126.

Respondents were not able to prove by clear and convincing evidence that the curves on the left side of Figure 5 as it was submitted to the PTO were based on the erroneous equation.

3. In Figure 5, Modine gave the examiner false information relating to the crevice element of claims 9 and 10. The patent specification represented that crevices "unexpectedly increase heat transfer," Showa Ex. 2, col. 5, ll. 49-50, and that crevices cause heat transfer that is "dramatically increased

over a circular passage with the same hydraulic diameter ...." Col. 6, 11. 20-22, col. 5, line 22-col. 6, line 42.

During the patent prosecution, Modine argued that its non-circular flow paths with elongated crevices contributed to the invention's improved performance over the prior art. See Child App., Showa Ex. 5 at 277, 427. In fact, Modine had no evidence proving that crevices improved performance of the condenser over prior art condensers.

Modine knew that the left side of Figure 5, which shows the performance of the structure disclosed in the '580 patent, was based on tests using round tubes. Guntly Tr. 982-84, 997; Guntly dep., Showa Phys. Ex. A at 269; see Showa Phys. Ex. A-26. Round tubes do not have crevices. Tests made on round tubes cannot be used to show the improved performance of tubes with crevices. Modine did not disclose to the examiner that its own tests in 1990, before the patent was issued, showed that round tubes and tubes with crevices performed equally well. Guntly Tr. 1001-02; Guntly dep., Showa Phys. Ex. A at 470. See Showa Ex. 88 at M062920-24. Modine failed to tell the examiner that it had no tests or evidence showing that crevices improved heat transfer. See Rohm & Haas, 722 F.2d at 1570-71, 220 U.S.P.Q. 298, 300-301.

Respondents proved by clear and convincing evidence that these misrepresentations about crevices and the failure to disclose were important to the examiner and therefore material. They misrepresented the advantages of the invention over the prior art.

As for intent, some people at Modine must have known that Figure 5 was based on tests of round tubes, so that there was either gross negligence in telling the examiner the benefits of crevices in connection with Figure 5, or an intentional failure to disclose material information once this information

was learned. The examiner had no way of knowing that the left side of Figure 5 was based on tests made on round tubes. Gross negligence alone is not enough to justify a finding of intent to deceive. Halliburton Co. v. Schlumberger Technology Corp., 925 F.2d 1435, 1442, 17 U.S.P.Q.2d 1834, 1841 (Fed. Cir. 1991). An intentional failure to disclose was not proved.

Three prior art references cited by the examiner against Modine's various claims were the Cat condenser, the Oohara patent and the Yoko patent. With respect to each, Modine made misstatements or failed to state the true facts.

The Cat Condenser: While prosecuting both the Parent and the Child Applications, Modine told the examiner that the inserts inside the Cat condenser tubes were bonded to the bottom but not the top of those tubes. In the Parent application Modine stated:

> the [Cat] insert will contact only one side of the tube leaving the other side of the insert spaced from the opposed side wall.... [T]he upper side of the insert is not in heat exchange contact with the corresponding side of tube. The examiner, as one skilled in the art, will readily recognize that this gap ... will impede heat transfer.

Parent application, Showa Ex. 4 at 190-91; see also 166-67.

In the Child application, Modine told the examiner that:

> Because, during the brazing process, the core is face down, the inserts lay on the lowermost side of the tube and only bond this surface.... Because the opposite or unbrazed side of the insert has a larger hydraulic diameter and thus is less resistant to flow, it would be expected that the majority of coolant flow and condensation would occur on such side of the insert. Thus, the efficiencies obtainable with the small hydraulic diameters taught by the applicants would not be fully recognized in [the Cat condenser].

Child App., Showa Ex. 5 at 276-77.

In fact, the insert was bonded on both the top and the bottom of the tubes, with approximately equal irregularity. See Showa Phys. Ex. C-62.

Modine has not denied that this disclosure to the PTO was inaccurate and that it knew of this inaccuracy. Saperstein dep., Showa Phys. Ex. C at 84-

86, 89-92. Modine argues that the inaccuracy was immaterial because the bonding of the insert on both the top and the bottom of the tube was incomplete along the length of the tubes and therefore the flow paths were not discrete.

Respondents point out that complete bonding of the insert to the wall of the tube was not necessary to create crevices. Claim 9 requires "at least one elongated crevice extending generally along the length of the associated flow path." Showa Ex. 2, col. 12, 11. 29-31. The '580 patent specification states that crevices need not extend along the entire length of the flow path. They must extend along "a substantial part of that portion of the flow path that is exposed to vapor." Col. 5, 11. 24-28.

The examiner had no way to learn for himself about the bonding in the Cat condenser or to consider whether the insert was bonded to the wall well enough to create crevices that would meet the crevices element of claim 9. The examiner had to rely upon what Modine told him about the Cat.

The Federal Circuit noted in LaBounty, 958 F.2d at 1076, 22 U.S.P.Q.2d at 1033, "(C)lose cases should be resolved by disclosure, not unilaterally by the applicant". In Paragon Podiatry Laboratory, Inc. v. KLM Laboratories, Inc., 984 F.2d 1182, 25 U.S.P.Q.2d 1561, 1568-69 (Fed. Cir. 1993), the examiner's inability to investigate facts was found to contribute to an inference of deceptive intent on the part of an applicant who misrepresented the facts. Because Modine was aware of the misrepresentation and because the examiner had no way to determine the facts except through Modine, it must be found that Modine intended to mislead the PTO on this point.

Although the Cat condenser was the most relevant prior art, the misrepresentation of the facts relating to bonding of the insert to the walls

of the tube in the Cat condenser does not appear to be material. Many other prior art references before the examiner disclosed bonding of an insert to the walls of the tube. It is doubtful that the examiner would have considered the degree of bonding achieved in the Cat condenser between the insert and the wall of the tube to be important to allowance of a claim.

Oohara: The Oohara patent is prior art to claims 9 and 10. Like those claims, it teaches discrete flow paths inherently containing crevices, an undulating insert brazed to the tube walls, and serpentine air fins. It did not teach straight parallel flow condenser tubes. In all three patent applications the examiner cited Oohara as the basis for rejections for obviousness. See Showa Ex. 3 at 36; Showa Ex. 4 at 147-48, 185, 194; Showa Ex. 5 at 287-90, 400-01, 456-57.

Modine's first misrepresentation with respect to Oohara was in an argument made to overcome a rejection by the examiner. Modine stated that Oohara did not teach the features claimed in the '580 patent because Oohara was directed to a multipass evaporator, while the invention was a single pass condenser. Parent App., Showa Ex. 4 at 161. See also Child App., Showa Ex. 5 at 360, 425. In fact, the Oohara patent specification expressly states that the invention "may be applicable to many applications such as a coolant condenser." Showa Phys. Ex. J, Tab 32 at 7.

Modine also misrepresented the hydraulic diameter taught by Oohara:

> Oohara does not disclose the claimed range of hydraulic diameters.... As nearly as we can determine, the smallest hydraulic diameter contemplated by Oohara, given the dimensions employed in the specification is a hydraulic diameter of 0.118 inches. This is far greater than the claimed range and ... will not produce the improved heat transfer shown to be obtainable through the use of the invention.

Showa Ex. 4 at 162.

In fact, Oohara does not disclose a hydraulic diameter of 0.118 inch. The hydraulic diameter disclosed in Oohara is substantially smaller than that. Webb Tr. 1216-19; Showa Ex. 27.

If the examiner had known that Oohara was applicable to a condenser and that the hydraulic diameter disclosed therein was lower than the applicant told him, these facts would have supported the examiner's position in rejecting the claims for obviousness. He rejected the claims as obvious anyway.

In J.P. Stevens & Co., Inc. v. Lex Tex Ltd. Inc., 747 F.2d at 1553, 223 U.S.P.Q. 1089, 1094-95, the Federal Circuit held that a reasonable rejection by the patent examiner because of prior art establishes the materiality of a later misrepresentation regarding the same prior art. Nevertheless, the examiner had the Oohara patent, he could read it for himself, and he did not accept Modine's argument. It is found that the misrepresentations were not material.

Yoko: Modine misrepresented the teachings of the Yoko patent in telling the examiner "Yoko does not clearly disclose whether the inserts are bonded to both sides of the interior of the tubes or merely to one side as is the case with the Cat folded front." Child App., Showa Ex. 5 at 424. This statement was inaccurate, and the examiner was not given a full English translation of the patent. Child App., Showa Ex. 5 at 457. Nor did Modine later correct the inaccurate statements. The statements about Yoko may have been related to the examiner later allowing the claims because of the microcracks argument. The examiner stated:

> Applicant further contends that Yoko 'does not clearly disclose whether the inserts are bonded to both sides of the tubes. . . .' Applicant's arguments concerning the flux coating o[n] the interior of the passages,

in light of the Japanese document and translation filed in paper no. 12, these arguments have been found to be persuasive ....".

id. at 457-58. Mr. VanSanten testified that in his opinion the examiner based his allowance of the claims not only on Modine's microcracks argument but also on the argument relating to Yoko's incomplete bonding. VanSanten dep., Showa Phys. Ex. B at 291. The misrepresentation of Yoko probably would not have been important to the examiner because bonding of inserts to tubes was disclosed in other prior art before the examiner. It was the microcracks argument, not Yoko alone, that persuaded the examiner to allow the claims.

There is no evidence that Modine's misrepresentation about Yoko was intentional; the examiner referred to the applicant's position as a "contention" that Yoko does not "clearly" disclose inserts bonded to both sides of the tube.

Respondents proved by clear and convincing evidence that in connection with Figure 5 there was an intent to mislead and that the misrepresentations and failures to disclose were material. Although there was no evidence of a clear pattern of misconduct, this was enough to establish that the patent was unenforceable due to inequitable conduct.

The misrepresentations and failures to disclose relating to the hydraulic diameter in one sense were not material because the examiner never said that he had changed his mind about allowing a range of hydraulic diameters with an upper limit of 0.040 inch as being anything other than a matter of design choice. If it were found that the examiner had changed his mind and had allowed any claims because he thought that a small hydraulic diameter in the range of 0.015 to 0.040 was patentable by itself over the prior art, then any

misrepresentations or failures to disclose relating to effects of a small hydraulic diameter would have to be considered material.

The examiner continued to reject all of the claims affected by the misrepresentations and failures to disclose until the applicant made the argument about the effects of microcracks. The prosecution history strongly suggests that the applicant never succeeded in persuading the examiner that any claim relying on a small hydraulic diameter combined with the other elements in the claims that were known in the prior art (such as crevices) should be allowed until the microcracks argument was made. If this were so, then all of the above misrepresentations and failures to disclose could be considered to be not material. But if this were so, claims 9 and 10 would be invalid because they do not include the microcracks element. Because claims 9 and 10 were allowed, they are presumed to be valid. It is therefore found that the '580 patent is unenforceable due to inequitable conduct.

INFRINGEMENT

CONSTRUCTION OF CLAIMS 9 AND 10

Claims 9 and 10 were construed in connection with determining whether these claims were valid. See page 7 above. The claims must be construed in the same way for the purposes of validity and infringement.

LITERAL INFRINGEMENT

Modine's complaint identified two condenser models made by Showa that it accused of infringing the '580 patent. At the hearing, Modine asserted that seven additional condenser models made by Showa were infringing. See Modine Ex. 48. All nine models were purchased by Modine in the United States. They include condensers made for the 1992 Mitsubishi Demand, the 1992 Mitsubishi 3000GT, the Mazda 929, the 1992 Honda Civic, the 1993 Audi, the 1993 Mercedes

Benz, and the 1993 Mitsubishi Mirage. Modine made more than one measurement of more than one tube from each condenser. Modine reported a hydraulic diameter range for each condenser tested. The ranges were: 0.0484-0.0519; 0.0453-0.0520; 0.0577-0.0477; 0.0577-0.0606; 0.0482-0.0497; 0.061-0.065; 0.0445-0.0682; 0.0424-0.0573;and 0.0513-0.0547.

The accused Showa condensers have two different types of tubes.

1. The first type of tube is 3mm high (with a 16mm width) and is found in most of Showa's condenser models, including the Mitsubishi GT 3000 and Diamante. The interior perimeter of all the 3mm tubes contains sawtoothed inner fins.

2. A small number of condenser models, including some for the Mitsubishi Mirage (included in Modine's accused condensers), use a second type of tube that has a height of 2mm (and a 20mm width). The 2mm tube does not contain those sawtoothed inner fins, but its hydraulic diameter is similar to the hydraulic diameter of Showa's 3mm tube, even though its free flow area is much smaller, because its wetted perimeter is much smaller without the sawteeth. See Modine Phys. Ex. III at 11-29.

The Showa condensers containing sawteeth:

Over [C]% of the accused Showa SC condenser tubes sold in the United States have interior walls that have sawteeth. See Shibata Tr. 1352; Modine Phys. Ex. III. These condensers do not contain "web means within said flat cross-section tubes and extending between and joined to the flat side walls" within the meaning of claim 9. They do not infringe claims 9 and 10.

Modine argued that the sawtoothed interior walls of the accused Showa tubes were flat walls with projections. Tr. at 319-320, 416-417, 494-495. The sawtooth interior walls of the tubes plainly are not flat as that term is

generally understood. The teeth that Modine describes as "projections" are integral parts of these walls, not attached to them by some type of bonding. If the sawtoothed walls are considered to be flat walls, it is difficult to see what a wall that is not flat would be. Perhaps all walls that are not circular in this patent should be considered to be flat, but this definition is so contrary to common sense that if this were the definition of flat wall in the patent, the patent specification should have said so.

The difference between the shape of the flow path shown in Figure 3 of the '580 patent and the shape of a Showa flow path with sawteeth, as shown in the photographs of Modine Physical Ex. III (11-23), for example, is obvious. The four internal walls of the Showa passages are covered with rows of rounded bumps. In the four corners of a passage there is sometimes a straight line or a short area that is relatively flat, but most of the internal surface area is rolling. The relationship of the flat walls to the crevices in the '580 patent is described in the patent specification at Columns 5 and 6 and depicted in Figure 3. At line 51 of Col. 5, the specification states: "The mechanism by which improved heat transfer is believed to occur is as follows."

No one is really sure what occurs inside a flow path of a condenser. See Carey Tr. 1432-1434. At the top of column 6, the patent describes what Modine thought was going on in the condenser of the invention. In the relatively flat areas between the corners, there would be a very thin film of refrigerant "having essentially no curved surface whatsoever." The film in the flat areas is thinned as the condensate flows to and collects in the crevices on both sides of the flat area. This thinned film provides less resistance to heat transfer. While it is true that no one knows whether this occurs in the condenser of the '580 patent, this is one of the features that Modine claims

as an unexpected benefit of its invention. It is difficult to see how this phenomenon could work in the same way in Showa's sawtoothed flow paths because they have few or no flat surface areas between crevices. Some other process may be going on in the sawtoothed flow paths. Dr. Marto testified that he would expect stronger surface tension forces pulling liquid down into the trough regions in the case of a triangular sawtoothed flow path than in the rectangular flow path of the PF condenser. Marto Tr. 798.

The hydraulic diameters of the accused condensers: The accused Showa condensers, regardless of whether they had sawteeth, were measured by Modine, and none had a hydraulic diameter smaller than 0.040 inch, the upper limit covered by claims 9 and 10. As a result, Showa's accused condensers do not literally infringe claims 9 and 10.

The hydraulic diameter of flow paths will vary within a single condenser. Modine's Responses to Staff's Second Set of Interrogatories, Showa Phys. Ex. O, Response to Interrogatory No. 27. Modine Ex. 48 shows that Modine measured the hydraulic diameter of more than one cross-sectioned tube for each condenser. Those measurements varied in the same condenser. For example, the hydraulic diameters for the single Audi condenser on page 5 ranged from .0682 inch (Mount Number 3500-9) to .0445 inch (Mount Number 3500-14). The hydraulic diameter of a single flow path at a single point within a condenser cannot be characterized as the hydraulic diameter of the flow paths of that condenser. Because of these variations in the sizes of the hydraulic diameters, the average of the hydraulic diameter measurements of flow paths in the tubes at different points in the condenser will be used as the overall hydraulic diameter. Modine itself urged the examiner in the '580 patent prosecution to use only the overall or average hydraulic diameter of the Cat

condenser (0.04822), instead of the variable hydraulic diameters of individual flow paths, for the same reason. Showa Ex. 4 at 192; Showa Ex. 5 at 364.

At the hearing Modine selected the smallest available individual sample measurements as the hydraulic diameter, rather than using the average hydraulic diameter. Modine measured more than three samples for all of the other condensers listed on its exhibit. Based on Modine's measurements in Modine Ex. 48, however, no Showa condenser had a hydraulic diameter below the upper limit of the patent claims, 0.040, and the hydraulic diameters found in only one Showa condenser fell below the overall hydraulic diameter of the Cat condenser (0.04822). This condenser was the one from the 1992 Mazda 929 that Modine purchased in October, 1991. According to Modine, it had a hydraulic diameter range of 0.0453-0.0477. While five measurements were given for that condenser, the measurements listed in Ex. 48 came from only three samples taken from the condenser. Mount Numbers MZ14 and MZ23 were measured twice, and different numbers were obtained in each measurement. The mount numbers for the samples of the Mazda condenser indicate that as many as 23 samples were taken from that condenser, but only three were selected for Modine Exhibit 48. Modine did not explain why these three samples were selected or whether they could be considered representative of the ones measured but not reported. The hydraulic diameter measurements of the three samples selected from this condenser are substantially smaller than the measurements of samples from two other versions of the same model condenser. Nevertheless, there is nothing in the record to show that respondents moved to compel the production of either the 23 samples or the measurements made by Modine on all 23 samples from this condenser. Modine Ex. 48 was received in evidence without objection by respondents.

In short, respondents argue that Modine's evidence about this Showa condenser is not worth believing, but they made no serious effort to prove that the condenser in fact had a higher average hydraulic diameter. On the other hand, the only evidence that Modine has offered of an SC condenser with any hydraulic diameter less than the average hydraulic diameter of the Cat is based on a limited number of samples selected by Modine from a much larger number of samples removed from a single condenser. The only evidence in the record on the hydraulic diameter range found by Modine in the Mazda condenser is not entitled to much weight. The hydraulic diameters listed by Modine in Modine Ex. 48 is, however, the only evidence relating to the hydraulic diameter of that particular condenser in the record. Both the upper limit and the lower limit of the hydraulic diameter range for this condenser are below the overall hydraulic diameter of the Cat condenser (0.04822) but above the upper limit of the hydraulic diameter range of claims 9 and 10 (0.040), so that the condenser does not literally infringe these claims. None of the other accused condensers literally infringes claims 9 or 10 of the patent.

INFRINGEMENT UNDER THE DOCTRINE OF EQUIVALENTS

Modine contended that if it is entitled to a range of equivalents up to the 0.04822 inch overall hydraulic diameter of the Cat condenser, Showa could be found to have infringed claims 9 and 10 based on a small number of individual flow path measurements made by Modine that indicated hydraulic diameters below this size in flow paths of Showa's condenser tubes. It is not clear whether Modine's numbers took into account variations in measurements that showed larger hydraulic diameters than those selected here.

Regardless of Modine's method of selecting the measurements that would be used to establish a range of hydraulic diameters for the Mazda condenser,

Modine is not entitled to a range of equivalents beyond the 0.040 inch literal scope of claims 9 and 10 for the reasons stated earlier under claim construction. Even if a wider range of hydraulic diameters were given to Modine under the doctrine of equivalents so that the element of claim 9 requiring a relatively small hydraulic diameter could be found in the accused Mazda condenser, that condenser may perform substantially the same function to obtain substantially the same result as the condenser of claims 9 and 10, but it does not do this in substantially the same way as the condenser of claims 9 and 10.

The doctrine of equivalents is not always available to patentees. In Pennwalt Corp. v. Durand-Wayland, Inc., 833 F.2d 931, 4 U.S.P.Q.2d 1737 (Fed. Cir. 1987), cert. denied, 485 U.S. 961, 1009 (1988), the Federal Circuit held that infringement under the doctrine of equivalents "may be found (but not necessarily) if an accused device performs substantially the same function or work, in substantially the same way, to obtain substantially the same overall results as the claimed invention." 833 F.2d at 934, 4 U.S.P.Q.2d at 1744 (citing Graver Tank & Mfg. Co., Inc. v. Linde Air Products Co., 339 U.S. 605, 608, 85 U.S.P.Q. 328 (1950)).

The Federal Circuit has on occasion indicated that the doctrine of equivalents should not be applied unless there is a compelling reason to do so. For example, the Court in London v. Carson Pirie Scott & Co., 946 F.2d 1534, 1538, 20 U.S.P.Q.2d 1456, 1458-59 (Fed. Cir. 1991) noted:

> Application of the doctrine of equivalents is the exception, ... not the rule, for if the public comes to believe (or fear) that . . . the doctrine of equivalents is simply the second prong of every infringement charge, regularly available to extend protection beyond the scope of the claims, then claims will cease to serve their intended purpose. Competitors will never know whether their actions infringe a granted patent.

The doctrine of equivalents should not be used to "erase a plethora of meaningful structural and functional limitations of the claim on which the public is entitled to rely in avoiding infringement." Malta v. Schulmerich Carillons, Inc., 952 F.2d 1320, 1327, 21 U.S.P.Q.2d 1161, 1166 (Fed. Cir. 1991), cert. denied, 112 S. Ct. 2942 (1992); Valmont Industries, Inc. v. Reinke Manufacturing Co., Inc., 983 F.2d 1039, 25 U.S.P.Q.2d 1451, 1454 (Fed. Cir. 1993); Charles Greiner & Co. v. Mari-Med Mfg. Inc., 962 F.2d 1031, 1035, 22 U.S.P.Q.2d 1526, 1529 (Fed. Cir. 1992).

The doctrine of equivalents is supposed to protect against "unscrupulous" copying. See London, 946 F.2d at 1538, 20 U.S.P.Q.2d at 1458-59. Lear Siegler, Inc. v. Sealy Mattress Co. of Michigan, Inc., 873 F.2d 1422, 1425, 10 U.S.P.Q.2d 1767, 1770 (Fed. Cir. 1989); Greiner, 962 F.2d at 1036, 22 U.S.P.Q.2d at 1529; Pennwalt, 833 F.2d at 935, 4 U.S.P.Q.2d at 1739. In this case the evidence does not support a finding that Showa copied the condenser disclosed in the '580 patent.

The Federal Circuit has held that the doctrine of equivalents is designed "to protect inventors from ... unanticipated equivalents." Kinzenbaw v. Deere & Co., 741 F.2d 383, 389, 222 U.S.P.Q. 929, 933 (Fed. Cir.), cert. denied, 470 U.S. 1004 (1984). In this case, the existence of hydraulic diameters larger than the 0.040 inch literal upper limit of Modine's claim was clearly anticipated in the Cat condenser. These anticipated equivalents were the reason for Modine narrowing its claim to avoid the hydraulic diameter of the Cat or any hydraulic diameter close enough to the hydraulic diameter of the Cat to be considered to be an obvious matter of design choice.

Moreover, Modine is not entitled to use the doctrine of equivalents to expand the range of hydraulic diameters beyond the range to which Modine

limited its claims in the prosecution history because any such expansion is barred by the doctrine of prosecution history estoppel.

Modine's narrowing arguments to distinguish its invention from the Cat condenser bar it from claiming hydraulic diameters larger than 0.040. In this particular situation there is no area of equivalents between the average hydraulic diameter of the Cat and the upper limit of claim 9 that the patentee can claim under the doctrine of equivalents. Prosecution history estoppel limits a patentee's reliance on the doctrine of equivalents by preventing the resurrection of subject matter surrendered for the purpose of avoiding a prior art rejection. Townsend Engineering Co. v. HiTec Co., Ltd., 829 F.2d 1086, 1090, 4 U.S.P.Q.2d 1136, 1139 (Fed. Cir. 1987); Loctite Corp. v. Ultraseal Ltd., 781 F.2d 861, 870-871, 228 U.S.P.Q. 90, 96 (Fed. Cir. 1985). The doctrine applies both to amendments to claims to overcome rejections based on prior art, and to arguments submitted to obtain the patent. Townsend, 829 F.2d at 1090, 4 U.S.P.Q.2d at 1139.

When a patentee, in order to get his claims allowed, tells an examiner that his claims do not cover certain subject matter and that his claims can be distinguished on that basis from the prior art, equity requires that an accused device that incorporates the surrendered subject matter not be held to infringe the patent. See Exhibit Supply Co. v. Ace Patents Corp., 315 U.S. 126, 136, 52 U.S.P.Q. 275, (1942).

In this case, the range of the hydraulic diameter in the prosecution claims was limited in the Parent application for the first time after the proposed claims covering a broader range were rejected in the Grandparent application as being obvious. Even if the patentee had not limited his claims to overcome a rejection, as he did here, as a matter of fairness the public

should be able to rely upon the arguments made by the patentee to the examiner as to what his claims covered. The patentee should not be able to retract these arguments as to how his claims should be construed once the patent is obtained. The Federal Circuit stated:

> The file on [the] patent, to which the public had access, explicitly showed that in response to the examiner's rejection, [the patentee] had narrowed his claims to a planter in which "the radius of the wheel . . . [is] less than the radius of the disc." [The patentee] offers no convincing reason why a competing manufacturer was not justified in assuming that if he built a planter in which the radius of the wheels was greater than that of the disc," he would not infringe the [ ] patent.

Kinzenbaw v. Deere & Co., 741 F.2d 383, 389, 222 U.S.P.Q. 929, 933 (Fed. Cir. 1984), cert. denied, 470 U.S. 1004 (1985).

Modine has attempted to limit the application of prosecution history estoppel in this case by asserting that the examiner would have allowed prosecution claim 27 at a hydraulic diameter larger than 0.040 inch. No one knows what the examiner would have allowed. The Supreme Court has held the patent applicant to a strict construction of his claims if the applicant surrendered another construction during the prosecution history. It did not matter whether the narrow construction was critical to the examiner in deciding whether to allow the claim. It did not matter whether the examiner would have allowed a broader claim. As the Federal Circuit recently has stated,

> Unmistakable assertions made by the applicant to the Patent and Trademark Office (PTO) in support of patentability, whether or not required to secure allowance of the claim, also may operate to preclude the patentee from asserting equivalency between a limitation of the claim and a substituted structure or process step.

Texas Instruments v. U.S.I.T.C., _____ F.2d ____, 1993 WL 63006, *8, 26 U.S.P.Q.2d 1018 (Fed. Cir. 1993).

The public is entitled to rely on narrowing arguments regardless of whether they were necessary for patentability. Kinzenbaw, 741 F.2d at 389, 222 U.S.P.Q. at 937; Polaroid Corp. v. Eastman Kodak Co., 789 F.2d 1556, 1570, 229 U.S.P.Q. 561, 572 (Fed. Cir.), cert. denied, 479 U.S. 850 (1986). In Mannesmann Demag Corp. v. Engineered Metal Products Co., 793 F.2d 1279, 1284-85, 230 U.S.P.Q. 45, 48 (Fed. Cir. 1986) the Federal Circuit rejected the patentee's argument that an applicant making a narrowing argument must be deemed to have "relinquished no more than was necessary to distinguish the references," and held that a patentee cannot recapture an interpretation that "falls squarely within the claim scope...relinquished to overcome the cited references", regardless of whether the surrender was necessary.

The prosecution history has been considered "in context," as required by Read Corp. v. Portec, Inc., 970 F.2d 816, 824, 23 U.S.P.Q.2d 1426, 1433 (Fed. Cir. 1992). In Read, the patentee distinguished a prior art reference by noting a long list of distinctions showing that its invention was not comparable. The patentee did not argue that any of those points of distinction was by itself a patentable advance. The Federal Circuit refused to create a separate estoppel for one distinction picked out of the long list. The court noted that the applicant never "argued for patentability over any prior art reference solely based upon [that distinction]." Read, 970 F.2d at 824, 23 U.S.P.Q.2d at 1433.

Here, the applicant did argue that his claims were allowable over the prior art reference (the Cat condenser) based solely on the applicant's use of the small hydraulic diameter. A small hydraulic diameter was an essential element of every prosecution claim, and the Cat condenser was the most significant prior art cited against the invention. Modine repeatedly argued

to the examiner that there were differences in the hydraulic diameters it claimed and those of the Cat condenser, and that these differences made the proposed claims allowable after they had been rejected.

When the patentee voluntarily made a narrowing argument or amendment to get his claim allowed, he should be bound by what he told the PTO, regardless of whether he had to narrow his claim to avoid the prior art. In Exhibit Supply Co., the Supreme Court noted that the applicant "recognized and emphasized the difference between the two phrases and proclaimed his abandonment of all that is embraced in that difference.... The difference which he thus disclaimed must be regarded as material, and since the amendment operates as a disclaimer of that difference it must be strictly construed against him." Exhibit Supply Co. v. Ace Patents Corp., 315 U.S. 136, 52 U.S.P.Q. at 275, 279, 280.

The parties argue as to whether the doctrine set forth in Exhibit Supply has been oversimplified by respondents. Although the case is rather old, the holding was strong and clear. The Federal Circuit has made inroads on the ruling in this case by making distinctions between the facts of this case and the facts in new cases to save a broad claim where it appeared equitable to do so. The clear ruling in Exhibit Supply, however, was to protect the public against a new construction by the patentee of a claim after he had abandoned the claim in the prosecution history where all who wanted to understand the scope of the patent could read it and try to design around it. If one bends over backwards to say that a patent applicant did not really mean to say what he said and that it should not be held against him, the rights of the public to make products that are not covered by the patentee's monopoly are threatened. Frequently the public has no notice other than the prosecution

history and the patent itself of what the patent claim means, and no voice in the case where the patent claim is construed.

Claims 9 and 10 have been construed as covering a hydraulic diameter range of 0.015 to 0.040 inch. In this case, the doctrine of equivalents cannot be used to extend this range because the applicant expressly gave up a broader range. Prosecution history estoppel limits an applicant who surrendered specific subject matter in order to obtain allowance of a claim from later asserting that the claim covers the abandoned subject matter under the doctrine of equivalents.

It is found that Modine surrendered any range of hydraulic diameter above 0.040, and that it did this for the purpose of avoiding the prior art Cat condenser. Modine understood that it could not claim hydraulic diameters right up to the 0.04822 inch hydraulic diameter of the Cat condenser without risking a finding that there was no patentable distinction between its claimed range and the Cat condenser's hydraulic diameter. To put some distance between its claim and the Cat condenser, Modine claimed hydraulic diameters only up to 0.040 inch, and surrendered any higher range. Modine pointed out that the Cat condenser's hydraulic diameter was "25% larger than the top end of the range claimed" by the invention. Modine decided to create this particular buffer zone between its invention and the Cat condenser to support its argument that its invention was nonobvious. Although there was already a small difference between the 0.040 of Modine's claim and the 0.04822 of the Cat, the applicant wanted to put a larger buffer between his claims and the prior art so that the examiner would see a patentable difference between the hydraulic diameter the applicant was claiming and the slightly larger hydraulic diameter of the Cat condenser. The doctrine of equivalents cannot

be used to eliminate this buffer. The greater the distance that Modine could put between the 0.04822 inch hydraulic diameter of the Cat condenser, the better Modine's chances of allowance would be. If the claimed range got too close to the number of the Cat condenser, the applicant knew that the claim would be rejected as obvious to one with ordinary skill in the art as an obvious matter of design choice. In this case, this is what the examiner said anyway. But in trying to persuade the examiner, the applicant decided to surrender any hydraulic diameter larger than 0.040 inch. Modine repeatedly admitted that it gave up the range of flow paths larger than 0.040 inch in hydraulic diameter for the purpose of avoiding the prior art Cat condenser. See Guntly dep., Showa Phys. Ex. A at 594-96; VanSanten dep., Showa Phys. Ex. B at 66-67; Saperstein Tr. 400-01. The fact that the examiner never allowed the claims on this basis alone does not permit the patentee to reclaim the buffer range later, at least without going back to the PTO to amend the claims.

Claims 9 and 10 were added after Modine already had given up the range above 0.040 inch. When Modine added claims 9 and 10, it did not suggest to the examiner that the term "relatively small hydraulic diameter" as used in prosecution claim 25 should cover a broader range, nor did it try to amend the specification, which expressly referred to a range between 0.015 and 0.040 inch. The applicant had stated that its "invention," not just specific claims or preferred embodiments, had flow paths no larger than 0.040 inch.

It is found that Modine intended the examiner to understand that claims 9 and 10 were limited to the 0.015 to 0.040 inch hydraulic diameter range, just as Modine's other claims were limited. And the examiner did have this understanding. He interpreted claims 9 and 10 as having an upper limit of

0.040 inch. In his rejection of prosecution claim 25 (which contained the "relatively small hydraulic diameter" element used in patent claim 9), he wrote that the hydraulic diameter was obvious in light of the small difference between the Cat condenser's hydraulic diameter and "the claimed range of 0.015 to 0.040 [inch]." Id. at 454-55.

In LaBounty, the Federal Circuit held that narrowing the scope of a claim limitation in order to avoid a prior art rejection will not preclude a patentee from asserting equivalents relating to unsurrendered subject matter, even with respect to the same limitation. LaBounty does not support the recovery of subject matter that was surrendered to avoid the prior art. Here, the applicant surrendered the entire range above 0.040.

Prosecution history estoppel precludes Modine from recovering that same subject matter under the doctrine of equivalents. Modine is not entitled to any range of equivalents for hydraulic diameters above 0.040 inch.

If the doctrine of equivalents could be used: If the doctrine of equivalents could be used to expand the range of the hydraulic diameter, the range of equivalents should be narrow because the '580 patent is not a pioneer patent but at best an improvement in a crowded field. Perkin-Elmer, 822 F.2d at 1532, 3 U.S.P.Q.2d at 1324; Pennwalt, 833 F.2d at 937, 4 U.S.P.Q.2d at 1741.

If the doctrine of equivalents could be used, it would not apply unless each element in the claim or its substantial equivalent is found in the accused device. Pennwalt, 833 F.2d at 935, 4 U.S.P.Q.2d at 1739; London, 946 F.2d at 1538, 20 U.S.P.Q.2d at 1458. An element is not a "substantial equivalent" of another unless it performs substantially the same function in substantially the same way to achieve substantially the same result, and

unless one of ordinary skill in the art would recognize the elements as equivalents. American Hosp. Supply Corp. v. Travenol Laboratories, Inc., 745 F.2d 1, 10, 223 U.S.P.Q. 577, 584 (Fed. Cir. 1984).

Two elements of claims 9 and 10, the "web means joined to the flat side walls" and the "relatively small hydraulic diameter" are not found in the accused Showa condensers. The substantial equivalent of the flat side walls element and the relatively small hydraulic diameter element are not found in the Showa condensers.

The flat side walls element: Most Showa condensers have sawteeth in the wall of the tube. These condensers do not have the element "web means joined to the flat side walls of the tube" or the substantial equivalent of that element. They do not work in the same way as the condenser of claims 9 and 10. Although Mr. Saperstein testified that the "flat side walls" element of claim 9 literally reads on Showa's SC condenser, it has been found herein that there is no flat side wall element in the SC condenser that has sawteeth in the interior walls. Modine offered no testimony that the sawtoothed walls performed substantially the same function in substantially the same way to achieve substantially the same result as the flat side walls of the condenser of claim 9. The sawtoothed flow paths are not the substantial equivalent of the "flat side walls" element of claim 9. The sawtoothed walls do not function in substantially the same way as the flat walls of the condenser of claim 9. In Showa's sawtoothed condenser there is no flat area that is thinned as the condensate is pulled to the two corners. Condensate may be pulled into the troughs of each sawtooth, See Marto Tr. 797, but Professor Marto testified that the surface tension forces may be different in Showa's flow paths. Tr. 794-797. In testifying about the equivalence between the

condenser of claims 9 and 10 and the SC condenser, Professor Marto suggested that equivalence might be found because the "same mechanisms" of vapor shear force and surface tension are in play. Tr. 744-754. On cross-examination, however, he agreed that "shear force is a mechanism in every condenser in some magnitude." Tr. 821-22.

The experts were not sure how the condenser of the '580 patent and the accused Showa condensers functioned, but they understood the effects of surface tension and vapor shear force, and were in agreement that these factors contributed to making both condensers work. Although vapor shear force and surface tension mechanisms are at work in both the accused condenser and the condenser of claims 9 and 10, this is not enough to find that the condensers operate in the same way. These mechanisms are present in all condensers.

The relatively small hydraulic diameter element: The substantial equivalent of the "relatively small hydraulic diameter" element would be found in the accused Showa condensers if the condenser designs were identical, although all of Showa's accused condensers have a hydraulic diameter larger than 0.040 inch. The range claimed by Modine was a matter of design choice. One cannot say that a hydraulic diameter functions in a particular way unless the design of the particular condenser is known. In the same condenser design, Showa's hydraulic diameters would perform substantially the same function in substantially the same way to achieve substantially the same result as the hydraulic diameter in the range claimed by Modine. One of ordinary skill in the art would recognize the elements as equivalents.

The hydraulic diameter in Showa's condenser does not perform substantially the same function in substantially the same way to achieve

substantially the same result as the hydraulic diameter of the PF condenser that practices claims 9 and 10.

When Modine was arguing that the accused SC condensers infringed claims 9 and 10, Modine wanted the range of the hydraulic diameter in claims 9 and 10 to be construed as including an upper limit of 0.070, rather than the upper limit of 0.040 referred to in the patent specification, prosecution history and some of the claims. In support of this position, Modine argued that the SC condensers perform in the same way as the condensers of claims 9 and 10 with respect to their "independence of gravity." The patent specification indicated that independence from gravity was an unexpected result of the invention. Showa Ex. 2, Col. 6, line 35.

Modine had made tests showing that its PF condenser, with a hydraulic diameter of 0.029, operated about as well in the horizontal or vertical position, with inlets at the top or bottom. Saperstein Tr. 426-26; Guntly dep., Showa Phys. Ex. A at 923-34; Costello dep., Showa Phys. Ex. F at 42.

Showa's SC condenser does not perform in the same way as the PF condenser. The SC condenser performs better in a vertical position with the inlet valve at the top, and the vapor flow moving down, than it performs in a horizontal position. It completely fails to operate in a vertical position with the vapor inlet placed at the bottom. Showa Ex. 10; Yamamoto Tr. 1172-1173.

Showa's condensers have flow paths with larger overall hydraulic diameters than the condenser of claims 9 and 10, they have extruded tubes, and most of these condensers have sawteeth, air fins, and baffling. Although Showa condensers obtain substantially the same results as the PF condenser in terms of achieving high heat transfer, Modine has not met its burden of

proving that its PF condensers and Showa's SC condensers achieve these results in substantially the same way.

The Showa SC condensers are not covered by claims 9 and 10 under the doctrine of equivalents.

THE DOMESTIC INDUSTRY

The parties have stipulated that Modine practices claims 9 and 10 of the '580 patent. Modine Exhibit 54-F. Modine Exhibit 54-E provides that if Modine makes products practicing the claims in the United States "at levels stated in the complaint," it will be stipulated that there is a domestic industry.

It is found that Modine's production levels of the PF condenser in the United States are well above the levels stated in the complaint. Pavlick Tr. at 600. [

confidential business information deleted

]. There is a domestic industry practicing claims 9 and 10 of the '580 patent.

CONCLUSIONS

1. It is found that the Commission has jurisdiction over the subject matter and the parties in this proceeding.

2. It is found that claims 9 and 10 of the '580 patent are invalid as anticipated under Section 102(b) of the Patent Act.

3. It is found that claims 9 and 10 of the '580 patent are invalid as obvious under Section 103 of the Patent Act.

4. It is found that claims 9 and 10 of the '580 patent, as construed herein, are not invalid as indefinite under Section 112 of the Patent Act.

5. It is found that if the '580 patent were valid, it would not be enforceable.

6. It is found that if the '580 patent were valid, it would not be infringed.

7. It is found that there is a domestic industry that practices claims 9 and 10 of the '580 patent.

8. It is found that the respondents have not engaged in an unfair act under Section 337 of the Tariff Act as amended.

The evidentiary record in this proceeding consists of all exhibits identified in Staff Ex. 1, Modine Documentary Exs. 1 and 2, and Showa Ex. 1. The evidentiary record also includes the transcript of the testimony at the hearing. The evidentiary record is hereby certified to the Commission.[1] The pleadings record includes all papers and requests properly filed with the Secretary in this proceeding.

Janet D. Saxon

Janet D. Saxon
Administrative Law Judge

Issued: April 23, 1993

[1] Pursuant to § 210.53(h) of the Commission's Rules, 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 motion 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).