

In the Matter of

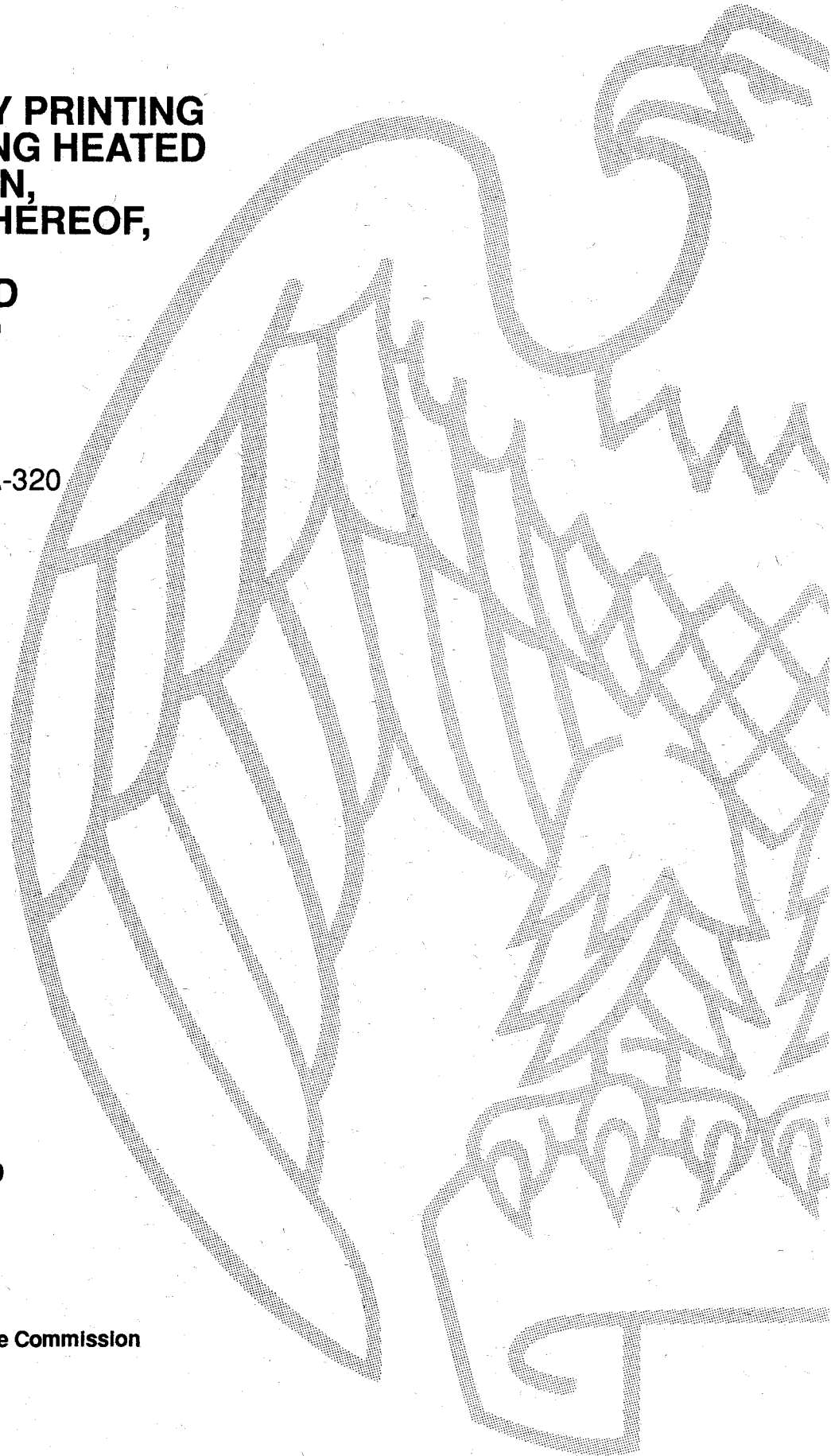
**CERTAIN ROTARY PRINTING
APPARATUS USING HEATED
INK COMPOSITION,
COMPONENTS THEREOF,
AND SYSTEMS
CONTAINING SAID
APPARATUS AND
COMPONENTS**

Investigation No. 337-TA-320

USITC PUBLICATION 2579

NOVEMBER 1992

**United States International Trade Commission
Washington, DC 20436**



UNITED STATES INTERNATIONAL TRADE COMMISSION

COMMISSIONERS

Don E. Newquist, Chairman
Peter S. Watson, Vice Chairman
David B. Rohr
Anne E. Brunsdale
Carol T. Crawford
Janet A. Nuzum

**Address all communications to
Secretary to the Commission
United States International Trade Commission
Washington, DC 20436**

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, DC 20436

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OFFICE OF THE
GENERAL COUNSEL
UNITED STATES
INTERNATIONAL
TRADE COMMISSION

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In the Matter of)
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CERTAIN ROTARY PRINTING)
APPARATUS USING HEATED INK)
COMPOSITION, COMPONENTS)
THEREOF, AND SYSTEMS)
CONTAINING SAID APPARATUS)
AND COMPONENTS)
_____)

Investigation No. 337-TA-320

NOTICE OF ISSUANCE OF LIMITED EXCLUSION ORDER

AGENCY: U.S. International Trade Commission.

ACTION: Notice.

SUMMARY: Notice is hereby given that the U.S. International Trade Commission has issued a limited exclusion order under 19 U.S.C. § 1337(d) to prevent the unauthorized importation into the United States of rotary printing apparatus using heated ink composition made or sold by or on behalf of Dato Pack Europa, S.A. of Barcelona, Spain and its successors or assigns, affiliated persons or companies, parents, subsidiaries, or other related business entities, which are covered by claims 1, 2, 3, 4, or 6 of U.S. Letters Patent 4,559,872.

FOR FURTHER INFORMATION CONTACT: Wayne W. Herrington, Esq., Office of the General Counsel, U.S. International Trade Commission, 500 E Street, SW., Washington, DC 20436, telephone 202-205-3092. Hearing-impaired individuals are advised that information on this matter can be obtained by contacting the Commission's TDD terminal on 202-205-1810

ADDRESSES: Copies of the limited exclusion order, the Commission Opinion relating thereto, and all other nonconfidential documents on the record of the investigation are or will be 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., Room 112, Washington, DC 20436, telephone 202-205-2000.

SUPPLEMENTARY INFORMATION: On October 23, 1990, Markem Corporation (Markem) filed a complaint with the Commission alleging a violation of section 337 of the Tariff Act of 1930 in the importation and sale of certain rotary printing apparatus using heated ink composition covered by claims 1,2,3,4, or 6 of U.S. Letters Patent 4,559,872, owned by Markem. On November 28, 1990, the Commission published notice of an investigation based on Markem's complaint. 55 Fed. Reg. 49437

On August 28, 1991, the presiding administrative law judge (ALJ) issued her final initial determination (ID) finding a violation of section 337 in this investigation. The complainant and the respondents petitioned for review of the ID. On October 15, 1991, the Commission issued notice of its decision to review the ID in its entirety.

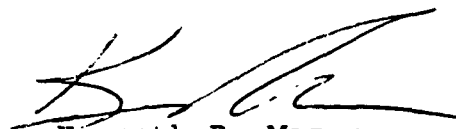
The Commission solicited written submissions from the parties to the investigation, other Federal agencies, and interested members of the public on the issues under review and on the questions of remedy, the public interest, and bonding. The Commission received submissions from all active parties.

After considering the submissions and examining the record developed during the investigation, the Commission determined that there was a violation of section 337, and that the appropriate remedy for the violation of section 337 was issuance of a limited exclusion order.

The Commission also determined that the public interest considerations listed in subsection (d) of section 337 do not preclude issuance of a limited exclusion order and that while the order is under review by the President pursuant to subsection (j) of section 337, the excluded articles will be entitled to enter the United States under a bond in the amount of 52 percent of the articles' entered value.

The authority for the aforesaid Commission determinations and the limited exclusion order is contained in Section 337 of the Tariff Act of 1930, 19 U.S.C. § 1337, and in sections 210.53-.59 of the Commission's Interim Rules of Practice and Procedure.

By order of the Commission.



Kenneth R. Mason
Secretary

Issued: February 28, 1992

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, DC 20436

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In the Matter of)
)
CERTAIN ROTARY PRINTING)
APPARATUS USING HEATED INK) Investigation No. 337-TA-320
COMPOSITION, COMPONENTS)
THEREOF, AND SYSTEMS)
CONTAINING SAID APPARATUS)
AND COMPONENTS)
_____)

ORDER

Having examined the pleadings and the record in this investigation and determined that there is a violation of section 337 of the Tariff Act of 1930 (19 U.S.C. § 1337) in the unauthorized importation and sale of certain rotary printing apparatus using heated ink composition; having examined the written submissions on the issues of remedy, the public interest, and bonding, and having determined that the public interest factors listed in subsection (d) of section 337 (19 U.S.C. § 1337(d)) do not preclude the remedy ordered in paragraph 2, it is hereby ORDERED THAT:

1. This investigation is terminated with a finding that there is a violation of section 337 of the Tariff Act of 1930.
2. Rotary printing apparatus covered by claims 1, 2, 3, 4, or 6 of U.S. Letters Patent 4,559,872, made or sold by or on behalf of Dato Pack Europa, S.A., of Barcelona, Spain, or any successors, assigns, affiliated persons or companies, parents, subsidiaries, or other related business entities are excluded from entry into the United States for the remaining term of the patent, except under license from the patent owner.
3. The articles ordered to be excluded from entry into the United States shall be entitled to entry under bond in the amount of 52 percent of the entered value of the imported articles from the day after this Order is received by the President pursuant to

subsection (j) until such time as the President notifies the Commission that he approves or disapproves this Order, but, in any event, not later than 60 days after receipt thereof.

4. The Secretary shall serve this Order upon the parties to the investigation and upon the Department of Health and Human Services, the Department of Justice, the Federal Trade Commission, and the U.S. Customs Service, and shall publish notice thereof in the Federal Register.

By order of the Commission.



Kenneth R. Mason
Secretary

Issued: February 28, 1992

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

RECEIVED
OFC OF THE SECRETARY
U.S. INTL TRADE COMMISSION

'92 JUN 23 P4:26

In the Matter of

CERTAIN ROTARY PRINTING APPARATUS
USING HEATED INK COMPOSITION,
COMPONENTS THEREOF, AND SYSTEMS
CONTAINING SAID APPARATUS AND
COMPONENTS

Inv. No. 337-TA-320

VIEWS OF THE COMMISSION¹

ERRATA

1. P. 2, l. 20, change "element" to "member".
2. P. 4, l. 2, change "1337(a)(2)-(3)" to "section 337(a)(2)-(3)".
3. P. 5, l. 3, change "112/6" to "112".
4. P. 6, n. 6, l. 4, insert "electrical" before "heating elements".
5. P. 8, l. 9, change "Back" to "Pack".
6. P. 8, l. 12, insert "any" before "suitable".
7. P. 11, l. 7, change "and" to "in".
8. P. 11, l. 9, change "metal" to "metals".
9. P. 11, l. 9, change "then" to "that".
10. P. 11, l. 16, change "ordering" to "ordinary".

¹ Commissioners Crawford, Nuzum and Watson did not participate in the disposition of this investigation.

11. P. 17, n. 15, l. 2, change "inventors'" to "inventor's".
12. P. 17, l. 14, change "'827" to "'872".
13. P. 18, l. 16, insert "the" before "third".
14. P. 20, l. 23, change "35" to "35/60".
15. P. 21, l. 25, change "U-shape'." to "U-shape'.".
16. P. 22, n. 16, l. 1, insert "Physical'" before "Exhibit" and "Exhibits".
17. P. 22, l. 14, insert "the" before "front".
18. P. 23, l. 4, change "elements" to "element".
19. P. 23, l. 6, change "flow" to "Flow".
20. P. 23, l. 7, change "heat" to "heats".
21. P. 23, l. 8, change "elements" to "element".
22. P. 23, l. 18, insert "way" after "same".
23. P. 23, l. 19, insert "Markem Review Brief, at 80, citing" before "TR-406-425".
24. P. 23, l. 25, change ".." to "..".
25. P. 24, n. 19, l. 6, delete "of" (second occurrence).
26. P. 24, n. 19, l. 7, delete "of".
27. P. 24, l. 10, insert "and Dato Pack" before "Physical".
28. P. 25, ll. 16-17, substitute "as" for "that are".
29. P. 26, l. 22, change "Richter" to "Richter,".
30. P. 27, l. 6, change "lay-persons" to "laypersons".
31. P. 29, l. 18, change "1458-89" to "1456, 1458".
32. P. 30, l. 6, change "Fed." to "(Fed.".
33. P. 30, l. 30, change "inventius" to "inventing".

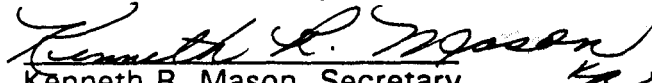
34. P. 32, l. 19, change "ink" to "the ink".
35. P. 33, l. 23, change "20-31" to "20-31."
36. P. 33, l. 26, change "high" to "high-".
37. P. 33, l. 28, change "metal rubber" to "metal-rubber".
38. P. 35, l. 1, change "Series" to "series".
39. P. 35, l. 11, change "simplify" to "supply".
40. P. 36, l. 14, change "temperature" to "temperatures".
41. P. 36, l. 14, change "those" to "these".
42. P. 43, l. 8, change "claim" to "claims".
43. P. 48, l. 26, change "determined" to "have determined".
44. P. 50, l. 9, delete "affiliates of".
45. P. 50, l. 19; change "distributorship" to
"distributorships".
46. P. 51, l. 20, change "19 USC 1337(d)" to "19 U.S.C.
§ 1337(d)-(f)".
47. P. 52, l. 14, change "be" to "should be".
48. P. 52, l. 26, change "would be" to "is often".
49. P. 52, l. 25, change "importers'" to "importer's".
50. P. 52, l. 26, change "importers'" to "importer's".

CERTAIN ROTARY PRINTING APPARATUS USING HEATED
INK COMPOSITION, COMPONENTS THEREOF, AND SYSTEMS
CONTAINING SAID APPARATUS AND COMPONENTS

337-TA-320

CERTIFICATE OF SERVICE

I, Kenneth R. Mason, hereby certify that the attached VIEWS OF THE COMMISSION ERRATA was served upon Juan Cockburn, Esq. and the following parties via first class mail, and air mail where necessary on June 24, 1992.



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PUBLIC

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In the Matter of)
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CERTAIN ROTARY PRINTING APPARATUS)
USING HEATED INK COMPOSITION,)
COMPONENTS THEREOF, AND SYSTEMS)
CONTAINING SAID APPARATUS AND COMPONENTS)

Inv. No. 337-TA-320

92 JUN 23 P 4:20

RECEIVED
DEC OF THE SEC
U.S. INTL TRADE

VIEWS OF THE COMMISSION 1/

I. INTRODUCTION

This investigation is before us for final disposition on review of an initial determination (ID) issued on August 28, 1991. With the exception of respondent Imaje 2/, we affirm the ALJ's conclusion that all respondents violated section 337. We also determine that the appropriate remedy is a limited exclusion order, that the public interest does not preclude that remedy, and that the amount of the bond permitting importation during the 60-day Presidential review period shall be 52 percent of the entered value of the goods involved.

1/ Commissioners Crawford, Nuzum and Watson did not participate in the disposition of this investigation.

2/ We find that Imaje is not a proper party to this case. See discussion infra.

II. PROCEDURAL HISTORY

On October 23, 1990, Markem Corporation ("Markem") of Keene, New Hampshire, filed a section 337 complaint against the importation of certain rotary printers. On November 20, 1990, the Commission instituted an investigation based on Markem's complaint. 55 Fed. Reg. 49437 (November 28, 1990). Our notice described the alleged violation of section 337 to be the importation into the United States, the sale for importation, or the sale within the United States after importation of certain rotary printing apparatus using heated ink composition, components thereof, and systems containing said apparatus and components thereof, which were alleged to infringe claims 1, 2, 3, 4 or 6 of U.S. Letters Patent 4,559,872 (the '872 patent). The complaint also alleged that an industry in the United States exists or is in the process of being established as required by subsections (a)(2) and (3) of section 337.

The '872 patent was issued on December 24, 1985 and assigned to Markem. The patent covers a special type of printer called a coder, which is used to print batch numbers, expiration dates, etc., on previously printed labels. Coders are used extensively in food and pharmaceutical packaging. Where the printing element of the coder is a roller, the coder is called a rotary coder. Rotary coders are preferably used with so-called "hot ink" compositions. These inks are solid at room temperature, but become liquid (and therefore useable) when heated. In many rotary coders, the solid hot ink composition is in the form of a roller, known as an inking roller, which can be heated.

The notice named the following five firms as respondents: Dato Pack Europa, S.A., Barcelona, Spain; Franklin Manufacturing Corp., Norwood, Massachusetts; Professional Sales Associates, Inc., Lake Bluff, Illinois; Dato Coding Systems, Inc., Ft. Lauderdale, Florida; and Imaje, S.A., Bourg Les Valence, France.

Respondent Dato Pack Europa makes and exports the accused products. Dato Coding Systems, Inc., imports them. Imaje owns almost a 100 percent interest in Dato Pack Europa, but does not make, export, or import the products. ID 4. The remaining two respondents distribute the accused products.

After instituting the investigation, we referred the case to the ALJ, who issued an ID on August 28, 1991. The entire ID is under Commission review.

III. DISCUSSION

A. VIOLATION OF SECTION 337: UNFAIR PRACTICES

Section 337(a)(1)(B)(i) makes unlawful the importation of articles which infringe the claims of a U.S. patent. Markem asserts that three of respondents' devices -- the Flow 35, Flow 60, and Flow S2 -- infringe its '872 patent both literally and under the doctrine of equivalents. ^{3/} The ALJ found that the Flow 35 and Flow 60 infringed, but that the Flow S2 did not. ID 29-45. The ALJ also

^{3/} The parties stipulated that the Flow 35 and Flow 60 are identical for the purpose of determining infringement.

found that Markem met the domestic industry requirement standard of 1337(a)(2)-(3). ID 45-46.

Respondents argue that the claims in controversy are invalid for obviousness, that they are not infringed, and that there is no domestic industry (i.e., that the Markem devices are not covered by the asserted claims). The ALJ rejected all of these defenses, except for noninfringement by the Flow S2. 4/

Overshadowing all of the issues in this review, however, is the construction of the asserted claims.

1. CLAIM CONSTRUCTION

The interpretation of patent claims is a question of law. The Federal Circuit has consistently held that claims should be construed in accordance with the language of the specific claim, and with reference to other claims, the patent specification, and the prosecution history. The terms in a claim are given their ordinary meaning to one of skill in the art unless it appears from the patent and its prosecution history that the terms were used differently by the inventor. Intellicall, Inc. v. Phonometrics, Inc., 952 F.2d 1384, 1387 (Fed. Cir. 1992), citing, Envirotech Corp. v. Al George, Inc., 730 F.2d 753, 759, 221 USPQ 473, 477 (Fed. Cir. 1984).

4/ The ALJ did not try or decide the defense of inequitable conduct and two defenses of invalidity based on 35 USC 101 and 35 USC 112. She found that respondents had raised those defenses too late in the proceeding to permit Markem a fair opportunity to respond.

The foregoing refers to conventional claim construction methodology. For claims which have elements in the special means-plus-function format of 35 USC 112/6, paragraph 6, there is a special rule of interpretation:

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

The claim construction issues in this case center on the last paragraph of claim 1 of the '872 patent:

1. A printing apparatus comprising:
 - a rotating printing member having at least one printing element thereon;
 - an inking roll for inking the printing element, said inking roll having a porous construction and being impregnated with an ink composition of the type which is solid at normal room temperatures and is rendered liquid or flowable at elevated temperatures;
 - and radiant heating means for maintaining the inking roll and the printing element on the printing member at elevated temperatures, said radiant heating means comprising a one-piece, substantially U-shaped member made of a solid block of thermally conductive material with one or more electrical heating elements therein, said U-shaped member having its closed end surrounding the inking roll and its open end partially surrounding the printing member. [Emphasis supplied.]

We must first decide whether and to what extent our construction of the '872 patent should be governed by 35 USC 112/6.

The parties agree that the first recitation of "radiant heating means" in paragraph 3 of claim 1 5/ should be construed in accordance with 35 USC 112/6 and that the second recitation of "radiant heating means"6/should be construed according to conventional claim construction methodology. 7/ The parties also agree that "radiant heating" modifies "means" in claim 1, and that the second recitation of "radiant heating means" further defines the first recitation of "radiant heating means." We also agree with this treatment. There remain the questions of (1) the interpretation of the term "radiant heating means," which appears in both recitations, (2) the interpretation of the remainder of the clause in the first recitation of "radiant heating means," and (3)

5/ The first recitation of "radiant heating means" is "radiant heating means for maintaining the inking roll and the printing element on the printing member at elevated temperatures."

6/ The second recitation of "radiant heating means" is "said radiant heating means comprising a one-piece, substantially U-shaped member made of a solid block of thermally conductive material with one or more heating elements therein. . ."

7/ While respondents agree with Markem that the two recitations of "radiant heating means" in paragraph 3 of claim 1 refer to the same element, they have argued that the second recitation does not further define the first. Rather, respondents argue that the limitations found in the second recitation are already included in the first recitation under 35 USC 112/6. They contend that the limitations of the second recitation represent a double inclusion of limitations already in the first recitation and that, as so considered, the claim is indefinite under 35 USC 112, second paragraph. Dato Pack Review Brief at 5-10. Respondents then suggest that this alleged indefiniteness can be avoided by construing the first recitation under 35 USC 112/6, and the second recitation under conventional methodology, so that the second recitation adds further limitations to the first recitation. Dato Pack Review Brief, pp. 10-11. Even if the issue of indefiniteness were properly before us (which it is not), respondents' path, though roundabout, leads to the same conclusion as Markem's.

the interpretation of the specific terms in the clause which constitutes the second recitation of "radiant heating means."

a. "Radiant heating means" (first and second recitations)

The phrase "radiant heating means" appears in both the first and second recitations, and its construction was a significant issue before the ALJ. She agreed with Markem that the term refers to any means which heats by radiant heating, even if it also heats by other means as well (i.e., conduction and/or convection). We also agree. We believe, however, that there is no substantive difference between any so-called non-technical definition and that which would be accepted by most scientists and engineers. Radiant heating is heat transmitted by electromagnetic radiation. ^{8/} In other words, radiant heating involves the transmission of heat by other than convection or conduction. See, Webster's Third New International Dictionary (1981). We believe that that is an appropriate definition. Radiant heating is familiar to anyone who has stood in front of a fireplace. We find nothing in the claims, the prosecution history, or anything else of record that would limit the claims to a heater which heated exclusively by radiant heating. And this was to be expected -- in the absence of a vacuum, radiant heating must be accompanied by convection. Therefore, we construe "radiant heating means" as a means which heats at least by radiant heating, but may also heat by conduction or convection.

^{8/} American Heritage Dictionary of Science (Houghton Mifflin; Boston (1986)).

b. Remainder of the first recitation

With regard to the remainder of the first recitation, the meaning of "maintaining the inking roll and the printing element on the printing member at elevated temperatures" is straightforward and does not appear to be the subject of any serious dispute. Markem and the respondents do appear to disagree on what constitutes the "corresponding structure ... described in the specification" for the specified function. Compare, Markem Review Brief, pp. 16-17 with Dato Pack Review Brief, pp. 11-16. The main difference, as articulated by respondents, is whether the material of which the heater block is composed should be regarded as being broadly described as "suitable thermally conductive material", as Markem suggests, or simply "aluminum", as respondents suggest. Dato Pack Reply Brief, pp. 1-2.

c. Specific terms in the second recitation

The parties also disagree on the construction of the various terms following the second recitation of "radiant heating means", i.e., the terms in the phrase "one-piece, substantially U-shaped member made of a solid block of thermally conductive material with one or more electrical heating elements therein." We construe each major term in turn.

"One-Piece". As noted above, terms in patent claims are given their ordinary meaning to those in the art, unless it is clear that some other meaning is intended. The ordinary meaning to those in the art may, of course, be the ordinary dictionary meaning, unless it is clear that there is an art-recognized meaning, which

does not appear to be the case here. Webster's Third International Dictionary (1981) defines "one-piece" as something that "consists of or is made in a single undivided piece (a one-piece bathing suit)."

9/ These definitions of the ordinary meaning of "one-piece" indicate that it not only can refer to an article made of a continuous piece of material, but can also include an article made of more than one continuous piece of material, providing that the individual pieces are permanently bonded together in such a fashion as to at least approximate the effect of an article which is made of one continuous piece of material for its intended purpose.

"Substantially U-Shaped" As with "one-piece," we find no reason to depart from the ordinary meaning of "substantially U-shaped". Webster's Third International Dictionary (1981) defines "U-shaped" as an article "having the shape of a capital U (a U-shaped statistical curve), specif.: resembling a broad U in cross profile (a U-shaped valley)." 10/ All definitions indicate that "U-shaped" means having a shape resembling the letter U. The word "substantially" obviously provides some leeway, but would still require reasonable resemblance to the letter U. We also note that

9/ Webster's Second International Dictionary (1956) defines "one-piece" as something which is "made in one piece; as, a one-piece undergarment or bathing suit." The Random House Dictionary of the English Language (Second Edition, 1987) defines "one-piece" as referring to an article which is "complete in one piece, as a garment: a one-piece snowsuit."

10/ Webster's Second International Dictionary (1956) and The Random House Dictionary of English Language (2d. ed. 1987) define the term similarly.

the claim calls for the "member" (the heater block) itself to be substantially U-shaped and not just a segment thereof.

"Solid Block." As to "solid block", Markem argues that this refers to "a piece of inflexible material that is neither liquid nor gaseous." Markem Review Brief at 29; "[a] solid block has thermal mass that stabilizes temperatures over time and reduces localized hot spots." Markem Review Brief at 30.

This term does not appear to have been separately addressed by the other parties. However, we believe that it would be more appropriate to define "solid block" as a block or block-like mass of material that is not hollow, *i.e.*, has no interior surfaces. This is consistent with the drawing and description of the heater block in the '872 patent.

"Thermally Conductive Material." Markem argues that "thermally conductive material" refers to "a material that is capable of conducting heat." Markem Review Brief, p. 30. It argues that the specification states that the heater block may be made of "any suitable thermally conductive material," and that "suitable" refers to any material that will make the heater block capable of radiating heat to the inking roll and printing wheel in order to melt the ink. Markem contends that the heater block therefore need not be made of aluminum (the specific example in the patent) or even metal, as long as it meets this functional requirement.

Respondents argue that Markem cannot escape the consequences of 35 USC 112/6 and therefore "an infringing device must include a heater block made of aluminum or a material equivalent to aluminum."

Dato Pack Review Brief at 14-15; Dato Pack Reply Brief at 11. Respondents miss the point. They are not construing the term, which appears in the second recitation, but are arguing that an infringing device must be made of material equivalent to aluminum under 35 USC 112/6 (first recitation).

We believe that the term "thermally conductive material" refers to those materials which those of ordinary skill and the art would regard as good conductors of heat. This would include aluminum and at least some other metal, but then list would not necessarily be exclusive if there were sufficient evidence to show that other materials are also regarded by the art as thermal conductors. We do not believe that any material which can eventually be heated to the required functional temperature is included in this definition. Such a definition would render the term "thermally conductive" meaningless surplusage. There is no persuasive evidence that those of ordinary skill in the art would interpret the term as Markem does. Indeed, the evidence is to the contrary. In the first place, the patent itself recognizes that some materials are insulators, e.g., plastics. '872 patent, col. 5, ll. 6-11. Heat-resistant plastics were clearly excluded even though, as the IA points out, any material can be raised to a given temperature. Persons of ordinary skill in the art do not use such a functional definition in determining whether a material is a thermal conductor, and there is no indication in the specification that the term is to be understood in any way other than the way those of ordinary skill in the art would understand it.

"One or more electrical heating elements therein." We believe that this term requires that at least one electrical heating element be present within the heater block. Markem's alternative reading, to require "that at least one electrical heating element be present within the previously defined 'radiant heating means'" is circular since the "radiant heating means" includes both the heater block and the heating elements and it is quite clear from the claim language (and consistent with the drawings and the specification) that the heating elements are in the block.

The meaning of the phrase "said U-shaped member having its closed end surrounding the inking roll and its open end partially surrounding the printing member" is self-evident and not in dispute.

2. VALIDITY

A patent is presumed valid. 35 USC 282. The burden of proving invalidity is on the party asserting it and must be met by clear and convincing evidence. Hybritech, Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 231 USPQ 81 (Fed. Cir. 1986). In this case, the ALJ found that the respondents had failed to establish that the '872 patent was invalid for obviousness under 35 USC 103. ID 22-29.

The criterion of obviousness is set forth in 35 USC 103. The pertinent portions of that section are reproduced below:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, 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. Patentability shall not be negated by the manner in which the invention was made....

The leading decision on obviousness is that of the Supreme Court in Graham v. John Deere Co., 383 US 1 (1966), which sets out four factors which must be considered: the scope and content of the prior art; the differences between the prior art and the claimed invention; the level of ordinary skill in the pertinent art; and objective evidence (the so-called "secondary considerations"). With these facts determined, the ultimate inquiry is best described by the Federal Circuit in Panduit Corporation v. Dennison Manufacturing Co., 810 F.2d 1561, 1566, 1 USPQ2d 1593, 1595-96 (Fed. Cir. 1987):

With the involved facts determined, the decisionmaker confronts a ghost, i.e., "a person having ordinary skill in the art," not unlike the "reasonable man" and other ghosts in the law. To reach a proper conclusion under section 103, the decisionmaker must step backward in time and into the shoes worn by that "person" when the invention was unknown and just before it was made. In light of all the evidence, the decisionmaker must then determine whether the patent challenger has convincingly established, 35 USC 282, that the claimed invention as a whole would have been obvious at that time to that person. 35 USC 103. The answer to that question partakes more of the nature of law than of fact, for it is an ultimate conclusion based on a foundation formed of all the probative facts.

The ALJ defined the pertinent art as including "rotary printing devices and other printing devices that print numbers or letters on packaging or tapes that can be applied to products or

packages." ID 22. While we agree with this definition, we note that the prior art which may be considered includes all analogous art. See n. 15, infra.

The ALJ (correctly, we believe) defined the level of skill in the art as follows: "One with ordinary skill in the art at that time [the time the invention was made] would have had the equivalent of a high school education and extensive practical experience with printers that are used as coders, including designing, manufacturing, operating or repairing them." ID 22-23.

As to the scope and content of the prior art, the ALJ pointed to four references relied upon by the respondents: (1) Japanese Patent Publication No. 57-129650; (2) Belgian Patent Publication No. 547050; (3) U.S. Letters Patent 3,412,707 to West; and (4) the Markem Model 904A rotary coder. ID 23. The West patent and the Markem Model 904A were before the U.S. Patent and Trademark Office (PTO) examiner during the examination of the '872 patent application.

At ID 23-27, the ALJ set out the differences between the prior art cited by the respondents and the claimed invention. The ALJ stated that the two prior art references which were not before the PTO examiner (the Japanese and Belgian patent publications) were no more pertinent than those prior art references that were considered by the examiner. Ultimately, she concluded that "none of the references relied on by the respondents, alone or in combination, suggests the device disclosed in the '872 patent." ID

27. The ALJ found that consideration of the objective indicia supported her conclusion of nonobviousness.

In their brief, respondents state that the essence of their argument is that the claimed invention is invalid for obviousness over the Japanese Patent Publication in view of the Belgian Patent Publication, or over the Markem Model 904A coder in view of the Belgian Patent Publication. Respondents argue that both the Japanese Patent Publication and the Model 904A coder have U-shaped heating members surrounding the inking roll, but not the printing roll, and that the Belgian Patent Publication would have suggested extending the U-shaped heating members of either of those two printers to surround a portion of the printing roll.

The Japanese Patent Publication 11/ discloses a printer of the general type discussed in the '872 patent, i.e., one using a heated ink composition. Thus, in the Japanese Patent Publication, a heater nearly surrounds an inking roll, heating the solid ink until it flows. Below the inking roll is an unheated printing roll which contacts the inking roll. The nature of the heater is not clear (and apparently unimportant to the invention there), so that it is impossible to say whether it is a "solid block of thermally conductive material" (as opposed to elements of resistance material) or whether there are heating elements inserted in such a solid block, as called for by the claimed invention. The shape of the

11/ Dato Pack Exhibit 68.

heater could well be called U-shaped, though Markem apparently would regard it as C-shaped and therefore not U-shaped.

The Markem Model 904A rotary coder 12/ is a predecessor of the claimed invention. In the Model 904A, a U-shaped (or perhaps C-shaped) heater nearly surrounds an inking roll, heating the solid ink until it flows. This heater is a solid mass of metal in which heating elements are inserted. Below the inking roll is a printing roll which contacts the inking roll. Unlike the printer of the Japanese Patent Publication, the printing roll of the Model 904A printer is heated, but by heating elements located in the shaft for the printing roll. 13/

The Belgian Patent Publication 14/ describes a "hot-process carboning machine." The patent describes "carboning machines" as "machines designed to apply to the reverse side of certain printed documents, bands of ink which carry information over onto several superimposed copies." The machine uses "firmer inks" which are heated in an "ink duct," apparently to liquid form. The "ink duct" appears from the drawing to be a heated tray. A roller is partially immersed in this tray. Another roller, called a transfer roller, is in contact with the first roller. The transfer roller is also in contact with a "plate-bearing cylinder". In turn, the plate-bearing cylinder is in contact with a press cylinder. Documents to be

12/ Markem Exhibit 11; Markem Physical Exhibit C.

13/ Details of the Model 904A may also be found in Markem Exhibits 7, 11, Dato Pack Exhibit 6 and Physical Exhibit HH.

14/ Dato Pack Exhibit 70.

carboned are fed between the plate-bearing cylinder and the press-cylinder. The plate-bearing cylinder is heated by a semi-cylindrical hood whose axis is parallel to the axis of the plate-bearing cylinder. The actual heating is done by electric resistors placed along the interior surface of the hood. The purpose of heating the plate-bearing cylinder is so that "printing may be performed at exactly the temperature desired, and there is no risk of having the ink cool during its passage from the ink duct to its application on the document."

We believe that the Belgian Patent Publication is analogous art 15/, but we do not believe it would render the claimed invention obvious. It does teach the desirability of heating the printing roller, but this is not the novel aspect of the claimed invention, since the '827 specification clearly refers to even closer prior art (hot-ink rotary printers of the type claimed, such as the Markem Model 904A) where the printing roll was separately heated by a heater in the printing roll shaft. It may also be viewed as showing a method of heating the printing roller externally, but by the direct use of heating elements, not a heating block, and not by the use of a single heater block to heat both the inking roller and the printing roller.

15/ Even if the Belgian Patent Publication might not be said to be "within the field of the inventors' endeavor," we believe it is "reasonably pertinent to the particular problem with which the inventor was involved," as specified in In re Wood, 599 F.2d 1032, 1036, 202 USPQ 171, 174 (CCPA 1979), and therefore should be treated as analogous art.

We find that there is no suggestion in the prior art to combine the references cited, nor would such a combination result in the claimed invention. This being the case, the objective indicia of nonobviousness need not be addressed since their presence is relevant only to show nonobviousness. Their absence does not show obviousness. Medtronic, Inc. v. Intermedics, Inc., 799 F.2d 734, 739 n. 13, 230 USPQ 641, 643 n. 13 (Fed. Cir. 1986).

3. INFRINGEMENT

The alleged infringing printers are respondents' models Flow 35, Flow 60, and Flow S2. The parties have treated the Flow 35 and Flow 60 models as essentially the same and have treated them as identical for the purpose of determining infringement. ID 30. The parties have also stipulated that the Flow 35, Flow 60, and Flow S2 meet all the limitations of the first two paragraphs of claim 1. They dispute whether the accused printers meet the limitations of third paragraph, which we have just construed.

Because we have reinterpreted the claims, we make the infringement analysis anew. Like the ALJ, we do this separately for the Flow 35/60 and the Flow S2. We keep in mind that the party alleging infringement (here complainant Markem) has the burden of proving infringement by a preponderance of the evidence. Envirotech Corp. v. Al George, Inc. 221 USPQ 473 (Fed. Cir. 1984).

A patent may be infringed either literally or under the doctrine of equivalents. It is literally infringed if each and every element of a claim is found in the accused device. Literal infringement of a claim containing a means-plus-function element is

determined by asking whether the corresponding means in the accused device which performs the recited function is the same as or an equivalent of the corresponding structure described in the patent specification. Texas Instruments, Inc. v. U.S. International Trade Commission, 805 F.2d 1558, 1562 (Fed. Cir. 1986). This means that the accused device must perform an identical function, but the "means" can be an equivalent. Spindelfabrik GmbH v. Schubert & Salzer, 829 F.2d 1075, 1085, 4 USPQ2d 1044, 1052 (Fed. Cir. 1987).

An allegation of infringement under the doctrine of equivalents presumes that literal infringement does not exist, *i.e.*, that the asserted patent claims, properly interpreted, do not in terms cover the accused device or process. The doctrine of equivalents permits infringement to be found if the accused device or process performs substantially the same function, in substantially the same way, to achieve substantially the same result as the claimed invention.

The leading case on the doctrine of equivalents is the decision of the Supreme Court in Graver Tank & Manufacturing Co. v. Linde Air Products, 339 U.S. 605 (1950), cited by the ALJ. See also Corning Glass Works v. Sumitomo Electric U.S.A., Inc., 9 USPQ2d 1962 (Fed. Cir. 1989). However, both the Supreme Court and the Federal Circuit have made it clear that, as it is designed to do equity, the doctrine of equivalents is not the prisoner of a specific formula. See Graver Tank and Corning, *supra*. In assessing infringement under the doctrine of equivalents, the cases frequently refer to the "range" of equivalents. The "range" of equivalents accorded depends

on the "pioneerness" of the claimed invention, with "pioneer" inventions being given a "broad range" of equivalents. As discussed below, the concept is of limited utility.

There are two established limitations to the doctrine of equivalents. First, the patentee may not recapture subject matter he gave up during prosecution of his patent application in order to obtain allowance of his claims. This is the doctrine of prosecution history estoppel, also called "file wrapper estoppel." Thomas & Betts Corp. v. Litton Systems, Inc., 720 F.2d 1572, 1579, 220 USPQ 1, 6 (Fed. Cir. 1983). Second, the doctrine of equivalents cannot be applied to cover a prior art device. Senmed Inc. v. Richard-Allen Medical Industries, Inc., 888 F.2d 815, 821, 12 USPQ2d 1508, 1513 (Fed. Cir. 1989).

The ALJ concluded that the Flow 35 literally infringed all asserted claims and that since the parties had stipulated that if the Flow 35 infringes, the Flow 60 also infringes, she found that the Flow 60 literally infringed all the asserted claims. ID 33-34. The ALJ also found that the Flow 35 and Flow 60 infringed under the doctrine of equivalents. However, the ALJ found that the Flow S2 did not infringe the asserted claims, either literally or under the doctrine of equivalents.

a. The Flow 35/60

The Flow 35 is exemplified by Dato Pack Physical Exhibit AA (and photos), Dato Pack Physical Exhibit L, and Markem Exhibits 6, 35-37. It is generally similar in appearance to the rotary coder

depicted in the drawings of the '872 patent, except that the heater block is not entirely open from front to back, but includes a rear plate as an integral part of the solid block. This rear plate has two holes, one near the top of the heater block and one near the bottom. The top hole is for the shaft for the inking roll. Extending from the bottom hole toward the interior of the heater block is a cylinder which is integral with the plate (and thus integral with the heater block) about which the printing roll turns. Four smaller holes surround the bottom hole and extend into, but not completely through, the cylinder. These four holes receive heating elements. These heating elements are the only heating elements in the solid block of the Flow 35/60.

Markem contends that the Flow 35 literally infringes all of the asserted claims. Respondents argue that the Flow 35 does not, because it does not meet the limitation that the heater block be "substantially U-shaped," a requirement of all claims. They point out that because the Flow 35 heater block includes a back plate (so that it is not open from front to back) and a central heating tube extending from the back plate, the overall shape of the heater block "is complex rather than the simple U-shape required by limitation (2)." Dato Pack Review Brief at 18. Markem counters that the claims only require that the heater block be "substantially" U-shaped and notes that there was testimony that "a Markem heater block [not a Flow 35 heater block] itself with 'rear plate' and 'central pipe' is 'nearly a U-shape'." Markem Reply Brief at 21-22. Markem refers to no testimony linking the shape of the Flow 35

heater block to the Markem 984 heater block and it is clear from inspection that the two are significantly different.^{16/} We do not believe the testimony cited can be relied on to establish that the heater block of the Flow 35 is "substantially U-shaped". Indeed, the same witness testified that the Flow 35 does not have a "substantially U-shaped" heater block.^{17/}

We find that the Flow 35 heater block is not "substantially U-shaped" as called for by the claims. As noted above, it is the entire heating block, not just a portion thereof, that must be "substantially U-shaped". The overall appearance of the Flow 35 heater block is not "substantially U-shaped," as an inspection shows. We agree with respondents that for an article to have a U-shape (or substantially a U-shape), it should have that shape viewed from either front or the back, as a letter U would have, and as is consistent with dictionary definitions of U-shaped. While part of the Flow 35 heater block may be substantially U-shaped, the Flow 35/60 heater block as a whole is not.

In view of the foregoing, we find that respondents' Flow 35/60 printers do not literally infringe any of the asserted claims. We will now discuss whether the Flow 35/60 should be found to infringe under the doctrine of equivalents.

Focusing on the third paragraph of claim 1, Markem argues that the heater block of the Flow 35 performs the same function as

^{16/} Compare Dato Pack Exhibit L with Dato Pack Exhibits XX and YY; See also Markem Exhibit 6.

^{17/} TR 869.

the heater block of claim 1, i.e., maintaining the inking roll and the printing element on the printing member at elevated temperatures so that the ink is rendered liquid or flowable and is maintained in that state on the printing elements until it is printed on the web.

Markem also argues that even though the electrical heating elements are in the tubular piece of the flow 35/60 heater block, the heater block still heat the inking roll and the printing elements in substantially the same way. Markem also argues that the Flow 35/60 heater block achieves substantially the same result, which it defines as "maintaining the ink in a liquid state until it is printed on the web." Markem Review Brief at 79-80.

Markem refers to the testimony of its expert witness, Dr. Richter, "that each of the features of the Flow 35/60 performed substantially the same overall function as the corresponding feature in the claims in substantially the same way to achieve substantially the same overall result, and that the Flow 35/60 machine taken as a whole performed substantially the same overall function as the claimed printing apparatus in substantially the same to achieve substantially the same result." TR 406-425.

Respondents simply state that there is no evidence of record that would support a finding that the Flow 35/60 infringes under the doctrine of equivalents because "[t]he record is devoid of evidence that the complex-shaped heater block in the Flow 35 and Flow 60 device is equivalent to the simple U-shaped heater block required . . .". Dato Pack Review Brief at 19. Respondents did not respond to Markem's arguments in their reply brief.

We find that the Flow 35/60 does infringe the asserted claims under the doctrine of equivalents. Markem must prove infringement by a preponderance of the evidence. The evidence cited in its review brief and particularly the testimony of Dr. Richter demonstrate the equivalency of the Flow 35/60. 18/ Since respondents have failed to contest that testimony or to refer to other evidence showing non-equivalency, Markem has made out its case. 19/

b. The Flow S2

The Flow S2 is exemplified in Dato Pack Exhibits 24, 25, 28, 29, Physical Exhibits A, B, CC, DD, and DDD. It is also a rotary coder having an inking roll and a printing roll. However, the inking roll and the printing roll have their own separate heating blocks. The heating block for the inking roll may be said to be C-shaped. The heating block for the printing roll might be said to

18/ Dr. Richter referred to the heater block of the Flow 35/60 as being "substantially U-shaped," apparently based on the construction of U-shaped as argued for by Markem. We have not accepted Markem's construction. Claim construction is a matter of law and therefore Dr. Richter's testimony does not and cannot affect that issue. His testimony does however demonstrate that the heater block of the Flow 35/60 is equivalent to that of the claimed invention.

19/ We note that claim 6 calls for a "backup roll." It is not clear whether respondents actually sell their printers with a backup roll. At TR 405-406, 424, Dr. Richter testified that the Flow 35/60 printer he tested required a back-up roll to operate, implying that it did not come equipped with one. If this is so, the alleged infringement by respondents of claim 6 would not be of direct infringement, but of contributory or induced infringement. The parties have not made such a distinction in their arguments, however, apparently preferring to treat the infringement as if it were direct. We treat this matter as the parties do.

have the shape of a set of parentheses () with an integral back plate from which a cylinder extends. The printing roll rotates around the cylinder. The heater blocks of the Flow S2 are separately heated. The heating elements of the inking roll are in the C-shaped block itself. The heating elements for the printing roll are in the cylinder. The separate heating blocks are encased in a hard, heat-resistant plastic material called PRIMEF so that the PRIMEF which holds them in place also separates them from one another and serves as a casing.

As with the Flow 35/60, it is stipulated that the Flow S2 meets the limitations of the first two paragraphs of claim 1. The dispute is with the third paragraph of claim 1.

The arguments of the parties turn on whether the record shows that PRIMEF is a "thermally conductive material," within the meaning of the claims. We agree with Markem that "thermally conductive material" is not limited to aluminum or to some other metals, that are specifically claimed in dependent claims. ^{20/} We do not, as mentioned above in the section on claim construction, agree that "thermally conductive material" is so broad as to cover any material which is capable of performing the intended function of heating the

^{20/} Under the so-called doctrine of claim differentiation, where there are two claims and one claim recites an element in generic terms and the other recites the same element in specific terms, the first claim will not be limited to the more specific term in the second claim, since to do so would not differentiate between the claims, *i.e.*, to do so would be to impermissibly treat one of the two claims as redundant. See, Tandon Corp. v. U.S. International Trade Commission, 831 F.2d 1017, 1023, 4 USPQ2d 1283, 1288 (Fed. Cir. 1987).

inking and printing rolls and which also possesses structural integrity at such elevated temperatures. No such definition appears in the specification, nor is such a definition implicit from the claim language. While the specification does refer to "suitable thermally conducting material", to use this phrase to cover any material which can ultimately reach the desired temperature and radiate heat, while possessing the necessary structural integrity, would deprive "thermally conductive material" of any meaning. In other words, it would not be necessary to use the term "thermally conductive" at all in the claims if we accepted Markem's definition, since eventually any material can be heated to any temperature unless it becomes molten or decomposes.

The question is what definition to give "thermally conductive." As noted above, we believe that the term "thermally conductive material" refers to those materials which persons of ordinary skill in the art would regard as good conductors of heat. We elaborate on that point here. In physics, the transport of heat energy between neighboring volume elements by virtue of the temperature difference between them is known as heat conduction. Zemansky, Heat and Thermodynamics (4th ed. 1957). How well a material conducts heat is referred to as its thermal conductivity. Id.; see also Richter TR 572. A substance with a large thermal conductivity is known as a thermal conductor and one with a small thermal conductivity is called a thermal insulator. Id. While these are definitions gleaned from a physics textbook, they describe notions that are intuitive and understood even by laypersons. For

example, consider a metal article and a wooden article in the same room. Both are obviously at the same temperature, but the metal article will feel much colder to the touch than the wooden article. This is because metal, being a good thermal conductor, conducts heat away from the hand more rapidly than wood, which is a poor thermal conductor (an insulator). Another example of how lay-persons distinguish between thermally conductive material and insulators is in the use of thermal insulation in the home. Few persons would regard fiberglass as a thermal conductor, else they would not use it to insulate their homes. The specification and the art distinguish between thermal conductors and insulators in the same way. Thus, the '872 patent specification distinguishes between aluminum and at least some other metals as thermal conductors and "heat-resistant" plastics. Compare, '872 patent, col. 3, ll. 13-17 with col. 5, ll. 5-10. Measured precisely, aluminum has a thermal conductivity of about 240 W/mK. Richter TR 573; Bonals TR 1028.²¹ There is testimony from Markem's expert which indicates that stainless steel has a thermal conductivity of 15-20 W/mK. Richter TR 573-74. However, even though stainless steel is a metal, there is record evidence that the art regards stainless steel as a poor conductor of heat. Dato Pack Exhibit 66, col. 6, ll. 24-26. There is even some indication that the inventor himself did not regard stainless steel as a thermal conductor. Perra, TR 315-317. PRIMEF has a thermal conductivity of 0.36 W/mK, well below that of stainless steel and

²¹/ W/mK stands for watts per meter Kelvin.

very much below that of aluminum. Respondents' expert testified that PRIMEF is an insulator. Bonals TR 1011-1013. 22/ Thus, there is ample evidence that the art would not recognize PRIMEF as a thermally conductive material within the meaning of the claims and, indeed, would recognize it as a thermal insulator.

In view of the foregoing, we conclude that Markem has failed to prove by a preponderance of the evidence that PRIMEF is a thermally conductive material within the meaning of claim 1. The implicit premise of Markem's argument is that the entire heater block of the Flow S2 is the "solid block" referred to in claim 1 and that the word "material" can include more than one material, i.e., the solid block may be of two different materials in the Flow S2, though both of these must be "thermally conductive." Since PRIMEF is not a "thermally conductive material" within the meaning of claim 1, the Flow S2 does not literally infringe claim 1 since what is argued to be the heater block by Markem is not a solid block of thermally conductive material, but rather a combination of two heater blocks of a thermally conductive material separated by PRIMEF, which is not a thermally conductive material.

Markem nevertheless tries to salvage its claim of infringement by arguing that the heater block of the Flow S2 performs the same overall function in substantially the same way to

22/ We note record evidence, cited infra, which shows that PRIMEF conducts heat so poorly that if only the top heater block is heated, the lower heater block will not become warm enough to permit useful operation.

achieve substantially the same result as the "radiant heating means" of the '872 patent.

i. Equivalents methodology for the Flow S2

Before addressing the merits of the question of equivalency, we note again that the most-frequently cited expression of the doctrine of equivalents is the tripartite Graver Tank test, i.e., that the accused device perform substantially the same function, in substantially the same way, to achieve substantially the same result as the claimed invention. We also note again that despite the frequency with which this statement is repeated, the Supreme Court in Graver Tank itself and the Federal Circuit have warned that the doctrine is not the prisoner of any formula, but being designed to do equity, may require consideration of a number of factors. ^{23/} An understanding of the doctrine of equivalents is perhaps best gained by understanding the competing policies which are said to underlie it. These policies are clearly enunciated in the recent opinion of the Federal Circuit in London v. Carson Pirie Scott & Co., 946 F.2d 1534, 1538, 20 USPQ2d 1458-89 (Fed. Cir. 1991), wherein the Court stated:

The standard for infringement under the doctrine of equivalents has often been articulated: infringement may be found if an accused device performs

^{23/} A recent article discusses the growing concern with exclusive reliance on the Graver Tank tripartite test in applying the doctrine of equivalents. Wegner, "The Doctrine of Equivalents After London", 74 Journal of the Patent and Trademark Society No. 1 (January 1992), p. 67. The article notes that the doctrine predates the expression (and perhaps even the existence) of some of the policies which are said to underlie it.

substantially the same function in substantially the same way to achieve substantially the same result. E.g., Graver Tank & Mfg. Co. v. Linde Air Prods. Co., 339 U.S. 605, 608, 85 USPQ 328, 330 (1950); Pennwalt Corp. v. Durand-Wayland, Inc., 833 F.2d 931, 934, 4 USPQ2d 1737, 1739 Fed. Cir. 1987)(in banc), cert. denied, 485 U.S. 961 (1988). This equitable doctrine evolved from a balancing of competing policies, each of which supports the Constitutional purpose of promoting the "useful arts." U.S. Const. art. I, § 8, cl. 8.

On the one hand, claims must be "particular" and "distinct," as required by 35 U.S.C. § 112, so that the public has fair notice of what the patentee and the Patent and Trademark Office have agreed constitute the metes and bounds of the claimed invention. Notice permits other parties to avoid actions which infringe the patent and to design around the patent. State Indus. v. A. O. Smith Corp., 751 F.2d 1226, 1236, 224 USPQ 418, 424 (Fed. Cir. 1985).

On the other hand, the patentee should not be deprived of the benefits of his patent by competitors who appropriate the essence of an invention while barely avoiding the literal language of the claims. See Laitram Corp. v. Cambridge Wire Cloth Co., 863 F.2d 855, 856-57, 9 USPQ2d 1289, 1291 (Fed. Cir. 1988), cert. denied, 490 U.S. 1068 (1989) (citing the additional opinions in Pennwalt as exhaustively discussing these competing policies). Accordingly, the doctrine of equivalents emerged. Although designing or inventing around patents to make new inventions is encouraged, piracy is not. Thus, where an infringer, instead of inventing around a patent by making a substantial change, merely makes an insubstantial change, essentially misappropriating or even "stealing" the patented invention, infringement may lie under the doctrine of equivalents. See Graver Tank, 339 U.S. at 609-10, 85 USPQ at 331; Lockheed Aircraft Corp. v. United States, 553 F.2d 69, 82, 193 USPQ 449, 461 (Ct. Cl. 1977). (Footnote omitted.)

Application of the doctrine of equivalents is the exception, however, not the rule, for if the public comes to believe (or fear) that the language of patent claims can never be relied on, and 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.

Thus, a more fundamental way of approaching the doctrine of equivalents is to keep in mind these underlying policies and that the purpose of the doctrine is to do equity. Framing the approach in these terms, the question becomes whether respondents have successfully "designed around" the '872 patent or have they merely made an "insubstantial change?"

ii. The place of the Flow S2 in the art

Whether a change is substantial or not depends on a number of considerations, including the place of the claimed invention in the art and the advance it embodies. As a threshold issue, tribunals have frequently tried to determine whether the claimed invention is a "pioneer" invention (like the telephone) and thus entitled to a "broad range of equivalents." Thus, in Texas Instruments v. U.S. International Trade Commission, 805 F.2d 1558, 1563, 231 USPQ 833, 835 (Fed Cir. 1986), the Federal Circuit stated: "It has long been recognized that the range of permissible equivalents depends upon the extent and nature of the invention, and may be more generously interpreted for a basic invention than for a less dramatic technological advance." The notion of a "range" of equivalents is intended to convey a general idea of how far the trier of fact may depart from the literal language of the claims and still find infringement under the doctrine of equivalents. In re Certain Doxorubicin, 20 USPQ2d 1602, 1608) (USITC 1990).

The ALJ found that the '872 patent is not a pioneer patent and therefore not entitled to a broad range of equivalents. ID 34. We agree. The prior art context of the claimed invention and the advance that the claimed invention made in the art can be gleaned from the specification and the prosecution history of the '872 patent.

Specification

At the time the claimed invention was made, coders or marking machines were known. The '872 patent specification states that it is important that such a marking machine be "as simple, reliable, and inexpensive as possible." '872 patent, Col. 1, ll. 35-36. A favored type of coder is one that uses ink which is solid at normal room temperatures and is rendered liquid or flowable at elevated temperatures. Col. 1, l. 53 to Col. 2, l. 2. To use such inks, however, it is essential that the printing or marking device be equipped with means for constantly maintaining the ink in a heated state while it is held on the inking roll as well as after it has been transferred to the printing element. Col. 2, ll. 3-8. If this is not done, premature cooling and drying of ink may occur, as for example on the surface of the printing element. This will result in poor print quality. Col. 2, ll. 8-11.

The specification describes two prior art solutions to the problem of heating the inking roll (as opposed to the printing roll):

In the past, heating of the inking roll was accomplished in one of two ways. The first method involved heating the shaft on which the inking roll was

arranged to rotate, so that heat was delivered to the inking roll by conduction. The second method involved partially enclosing the inking roll in a curved metal heater block with embedded electrical resistance heating devices. This provided a sufficient amount of radiant heat to the inking roll to maintain the ink in a liquid or flowable state.

Col. 2, ll. 11-20.

With regard to heating the printing roll, the specification refers to the following prior art solution:

In either case, a separate heating device was required for the printing member in order to prevent cooling and drying of the ink after transfer to the printing elements. This was implemented by means of a separate metal heater block equipped with embedded electrical resistance heating devices and held in contact with the rear faces of the printing elements, the latter usually consisting of metal type. In this way, the printing elements were heated by conduction from the heater block in order to maintain the ink in its liquid or flowable state until contact with the surface to be printed.

Col. 2, ll. 20-31

The specification identifies two problems with these prior art printers. First, the printing elements had to be good conductors of heat but resistant to damage from contact with high temperature surfaces. This limited the materials to be used to metal type or composite metal rubber type. Col. 2, ll. 32-44. Second, there were problems making electrical connections to the heater block for the printing member, especially where that member was a rotary member. This introduced undesirable complexity into the apparatus. Col. 2, ll. 44-58.

The specification states that these problems were solved in the claimed invention "by utilizing external heating means for both the inking means and the printing member." Col. 2, l. 61-Col. 3, l. 3. More specifically, the external heating means was described as "unitary" (Col. 3, ll. 4-13) and further that "[t]he heating means may comprise a one-piece, substantially U-shaped member made of a thermally conductive material, preferably a metallic material such as aluminum, with one or more electrical heating elements embedded therein." Col. 3, ll. 13-17.

In sum, the specification itself makes it clear that rotary coders with external heating means for the inking roll were well known. The specification also makes it clear that the desirability of heating the printing roll was known and that there were rotary coders with separate internal heaters for the printing roll. The West patent and the Belgian Patent Publication show that it was known to heat printing rolls in other types of printing apparatus (for hot wax carbon printing or carboning) by separate external radiant heaters. The Markem Model 904A showed a block-type radiant heater with inserts in a rotary coder, though this was only implemented for the inking roll.

It is clear from the foregoing that the advance in the art by the claimed coder was not simply the external heating of both the inking roll and the printing roll of the rotary coder. Rather, the advance was externally heating both the inking roll and the printing roll of the rotary coder by a single, unitary heating block. Markem states as much on page 38 of its review brief:

The 904 Series and '872 patent claims differ in that the 904 series used a solid inverted C-shaped radiant heater for the ink roll and a rotating, conductive heater for the print roll. Markem Ex. 11, photograph No. 1. The inverted U-shaped radiant heater of the '872 patent, on the other hand, continues in the vertical direction to not only surround the ink roll, but also the print wheel, and dispenses with an internal rotating conductive heater for the print roll that requires a brush and slip ring arrangement to simplify electric current to the rotating heater. Compare, Markem Ex. 11, photograph No. 1 with Markem Exhibit 2, Figure 1.

That the advance in the art is the single, unitary heating block is shown by other statements in the specification. Thus, the preferred embodiment described in the specification uses such a single, unitary heating block and various advantages are attributed to such a single, unitary heating block. The specification refers to the single, unitary heating block as an "important feature" of the claimed invention: "In accordance with an important feature of the present invention, a one-piece, wrap-around radiant heater block 34 is provided around the inking roll 24 and the printing roll 26." Col. 4, ll. 52-55.

In addition to the specification, the prosecution history is replete with references to the importance of the single, unitary heating block. In his first office action, the PTO examiner rejected the original claims for anticipation over a patent to West and for obviousness over the West patent in combination with patents to Andrews, Jenness III, Chapman, and Barnak. Markem Exhibit 5. In response, Markem cancelled the original claims and substituted new claims 21-29. In distinguishing the new claims over West, which had

been the basis of the anticipation rejection, Markem stated in part as follows:

In the claims as presently written, the radiant heating means is defined rather specifically as a one-piece, substantially U-shaped member made of a solid block of thermally conductive material with one or more electrical heating elements therein. The U-shaped member is required to have its closed end surrounding the inking roll and its open end partially surrounding the printing member. Thus, the "unitary" aspect of the radiant heating means has been clarified and its "surrounding" relationship with the inking roll and the printing member, which is an important feature from the standpoint of maintaining uniform temperature on those rolls, has been defined more precisely. The new claims clearly exclude West because the heating device 30 of West is not a one-piece, substantially U-shaped member made of a solid block of thermally conductive material, and it does not surround an inking roll and printing member in the manner specified. On the contrary, the only roller even partially surrounded by the device 30 of West is the plate roller 11. Further, the device 30 consists not of a one-piece member or solid block, but instead of a number of separate quartz heater tubes 33, 34 enclosed in what appears to be a cover or housing. This type of construction lacks the temperature stabilization and temperature uniformity that can be obtained with a solid block of thermally conductive material. As West points out, quartz tubes attain maximum heat almost instantaneously and lose about 80 percent of their heat output within two seconds after the current is shut off (col. 4, lines 61-68). Thus, temperatures can fluctuate drastically unless the power level to the tubes is carefully controlled. There is also the problem of "hot spots" on the surface of the plate roller, resulting from the localized heat produced by the separate tubes 33. In the present invention, the solid block of thermally conductive material provides a significant thermal mass which tends to stabilize the temperature of the radiant heating device over time, and which also reduces localized hot spots. These advantages are important in the present invention because optimum printing is obtained with thermoplastic hot-melt ink compositions when consistent and uniform temperatures are maintained in the printing apparatus.

Markem Exh. 5.

Markem's remarks show that it considered the "one-piece" and "surrounding" limitations important and used them to distinguish the claimed invention from West.

With regard to the rejection of the original claims under 35 USC 103 over West in view of Andrews and Jenness III, Markem premised its argument on the assertion that Andrews was non-analogous art. Markem "noted" the examiner's rejection of several of the original claims under 35 USC 103 in which he referred to Jenness III, Chapman, and Barnak, but stated that it believed these had been overcome by the substituted claims. Markem then made an extensive comment on the Jenness III prior art patent:

Regarding the commonly assigned patent to Jenness, III, it should be noted that the type of printing apparatus described in this patent is acknowledged as prior art in the background section of the present application at page 3, lines 3-17. The Jenness, III patent employs a curved radiant heater block 232 (Fig. 16) for heating the inking roll 69 with radiant heat, and a separate heater block 34 (Fig. 14) for heating the printing elements 37, 38, and 39 by conduction. By contrast, the present invention employs a single radiant heating device for heating both the inking roll and the printing elements by means of radiant heat. This represents a considerable simplification in physical structure as well as in the needed electrical circuitry, since only one temperature regulating circuit is required. Generally, the Jenness, III arrangement is useful in the case of reciprocating printing members which undergo complex motions, whereas the present invention finds its greatest utility in connection with rotary printing members which can be confined to rotate along with an inking roll within a one-piece radiant heating device.

Markem Exhibit 5.

Markem thus distinguished the claimed invention from Jenness III on the basis of one as opposed to two heating blocks and that the enumerated advantageous results are obtained when that construction is used, results not obtained by the prior art.

In view of the importance ascribed to this limitation of one heater block which surrounds both the inking roll and the printer roll, both as to the advantages obtained thereby and avoidance of the prior art, we believe that a heating means such as that of the Flow S2 which has two heater blocks, one of which surrounds the inking roll and the other of which surrounds the printing roll, is more than an "insubstantial change" from the claimed invention.

Examining the Flow S2 from the perspective of the frequently-cited Graver Tank tripartite test, it is clear that the heater blocks of the Flow S2 do maintain the inking roll and the printing roll at elevated temperatures, which may be referred to as the function of that element. They do not do so in substantially the same way, however. It is true, as Markem says, that each heater block uses radiant heat, as in the claimed invention, but this is not enough to meet Markem's burden of showing that the two heater blocks function in the same way as the single block of the claimed invention. This is so since it is clear that the two heater blocks of the Flow S2 do not function as a unit, and it is clearly essential to the simplicity of the construction and circuitry of the claimed invention that the heating block operate as a single solid block. The Federal Circuit has recently indicated that a significant variation in design, flexibility, and simplicity may

justify a finding of nonequivalence in an appropriate context. See, Malta v. Schulmerich Carillons, Inc., ___ F.2d. ___, 21 USPQ2d 1161 (Fed. Cir. 1991).

iii. File wrapper estoppel

Even if Markem's argument that both heater blocks of the Flow S2 heat by radiant heat were accepted as sufficient to show that they operate in substantially the same way as the heater block of the claimed invention, and even if Markem's argument that the Flow S2 permits the ink to remain liquid on the inking and printing rolls were accepted as sufficient to show substantially the same result (notwithstanding the failure of the Flow S2 to attain the advantages of structural and electrical simplicity of the claimed invention), a finding of infringement would be precluded by file wrapper estoppel.

The doctrine of file wrapper estoppel precludes a patent owner in an infringement suit from obtaining a construction of or coverage by a claim that would effectively resurrect subject matter surrendered in the course of proceedings before the PTO. Chisum, Patents, § 18.05. The classic case for file wrapper estoppel is where a patentee has narrowed his claims to avoid prior art cited by the PTO against his application. Chisum, Patents, § 18.05[2]. The Court of Customs and Patent Appeals (now the Federal Circuit) has held, however, that the estoppel may also apply with respect to arguments made during prosecution even if the claims were not amended. Coleco Industries, Inc. v. U.S. International Trade Commission, 573 F.2d 1247, 197 USPQ 472 (CCPA 1978). The fact that the claims were narrowed by adding further limitations (or argued to

be narrower than they otherwise might be interpreted) does not itself preclude any reliance on the doctrine of equivalents. Rather, the Federal Circuit has made it clear that an examination of what was given up and the reasons why must be undertaken. LaBounty Manufacturing, Inc. v. U.S. International Trade Commission, 867 F.2d 1572, 9 USPQ2d 1995 (Fed. Cir. 1989) and see analysis, Sun Studs, Inc. v. ATA Equipment Leasing, Inc., 872 F.2d 978, 10 USPQ2d 1338 (Fed. Cir. 1989), modified, 872 F.2d 978 (Fed. Cir. 1989) and Environmental Instruments, Inc. v. Sutron Corp., 877 F.2d 1561, 11 USPQ2d 1132 (Fed. Cir. 1989).

We have examined the file wrapper and agree with respondents and the IA that, even if the Flow S2 were otherwise equivalent to the claimed invention, Markem is foreclosed from extending the coverage of its claims that far because, under the doctrine of file wrapper estoppel, Markem clearly surrendered coverage of any printer which has separate heating blocks for the inking roll and the printing roll and did so to overcome prior art. Throughout the prosecution history Markem emphasized that its heater block was in a single piece and that the single piece structure offered advantages over prior art, including prior art that clearly used a two-heater structure, as the previously quoted material shows.

Further, it is clear from the prior art, such as the Markem 904A, that having two separate heaters was clearly possible and used in printing apparatus, including coders. This is therefore not a case where Markem could not have anticipated a future development. Nevertheless, Markem never asserted at any time that it intended to

cover any such devices having two separate heaters. Rather, as pointed out above, Markem relied on the one-piece construction of its heater block because it distinguished from the prior art and because its single-piece construction offered advantages that the prior art could not.

We therefore find that even if the Flow S2 could be found to be equivalent to the claimed invention, Markem is precluded by file wrapper estoppel from asserting that it can cover devices with two separate heaters, such as the Flow S2 device.

iv. Encroachment on prior art

Respondents argue that even if the Flow S2 were found to be equivalent to the claimed invention and even if such equivalence were not foreclosed by file wrapper estoppel, Markem cannot extend the doctrine of equivalents to cover the Flow S2 because to do so would be to encroach upon prior art.

The arguments on encroachment on the prior art are not sufficiently developed to permit us to make a decision thereon. In any event, since we have found that the Flow S2 is not equivalent to the claimed invention and that file wrapper estoppel applies to preclude such equivalency even it might otherwise be found, we need not reach the question of whether the equivalents argument advanced by Markem would result in an encroachment upon prior art.

B. VIOLATION OF SECTION 337: DOMESTIC INDUSTRY

Prior to the passage of the Omnibus Trade and Competitiveness Act (OTCA) in 1988, there was an "industry" requirement for all

section 337 cases, though the term "industry" was undefined. There was also a requirement that the industry be "efficiently and economically operated." The OTCA eliminated the "efficiently and economically operated" requirement for all cases and set forth a specific industry definition at section 337(a)(2)-(3) for certain intellectual property cases:

(2) Subparagraphs (B), (C), and (D) of paragraph (1) apply only if an industry in the United States, relating to the articles protected by the patent, copyright, trademark, or mask work concerned, exists or is in the process of being established.

(3) For purposes of paragraph (2), an industry in the United States shall be considered to exist if there is in the United States, with respect to the articles protected by the patent, copyright, trademark, or mask work concerned --

- (A) significant investment in plant and equipment;
- (B) significant employment of labor or capital; or
- (C) substantial investment in its exploitation, including engineering, research and development, or licensing.

The ALJ stated that respondents have stipulated that if Markem practices the patent, there would be a domestic industry with respect to the rotary coders sold by Markem. ID 45. Respondents argue that Markem is not exploiting the '872 patent because the Markem Model 984 and the other rotary coders Markem relies upon are not covered by the asserted claims, because the heater blocks of these coders include a partial back plate and a central heating pipe or ring that extends from that partial back plate. This deprives the heater blocks, in their view, from having a simple 'U'-shape that is open from front to back. Respondents argue that the record shows that these coders would not work satisfactorily without this

modification and therefore they are not equivalent to the asserted claims and, indeed, that there is no evidence that they are equivalent. Dato Pack Review Brief, pp. 26-27.

We agree that Markem has established the existence of a domestic industry with respect to the asserted claims of the '872 patent. Markem and the IA have presented record evidence to show that the coders in question meet all the limitations of those claims. The claim calls only for a "substantially" U-shaped heater block. Simple inspection of the Markem coders shows that they meet this limitation. ^{24/} We therefore find that the Markem coders literally meet all the limitations of the asserted claims. There is no dispute that these coders are made in the United States. Therefore, we find that Markem has established by a preponderance of the evidence that there is an industry in the United States exploiting the asserted claims of the '872 patent.

C. PROPER PARTIES

We requested the parties to address the basis for asserting liability for infringement for each respondent, and in particular, respondent Imaje, S.A.

^{24/} This is not inconsistent with our finding of no literal infringement with respect to the Flow 35/60, since the heater block of the Flow 35/60 cannot, when viewed from both sides, be seen to be substantially U-shaped, while the partial plate in the Markem coders does permit their heater blocks to be seen from both sides as being substantially U-shaped.

Whether or not Imaje is a proper party and whether or not it is liable for infringement, the Commission's remedial orders may be drafted to preclude infringing imports by firms or persons related to those respondents found to be infringing.

We understand Markem to be arguing an alter ego theory of liability, which requires that the subsidiary be a mere instrumentality of the parent. While it is clear that there is more than a simple shareholding arrangement between Imaje and Dato Pack Europa, we believe the evidence is insufficient to find that Dato Pack is the alter ego of Imaje. Certainly, the relationship of the two companies falls short of the relationship found by the district court in Milgo Electronic Corporation v. United Business Communications, Inc., 623 F.2d 645 (10th Cir. 1980), on which Markem primarily relies. Swift Chemical Company v. Usamex Fertilizers, Inc., 197 USPQ 10 (E.D. La. 1977) and Coleman v. Corning Glass Works, 619 F. Supp. 950, 226 USPQ 991 (W.D. N.Y. 1985) are likewise inapplicable.

D. REMEDY, PUBLIC INTEREST, BONDING

Once the Commission finds a violation of section 337, it must decide the issues of remedy, public interest, and bonding. In this case, these issues are:

1. (a) Whether Markem has satisfied the criteria for discretionary issuance of a general exclusion order, as opposed to a limited exclusion order, and what should be the terms of any exclusion order issued:
 - (b) Whether Markem has satisfied the criteria for issuance of cease and desist orders, and

what should be the terms of any cease and desist orders issued.

2. Whether consideration of the statutory public interest factors precludes the issuance of any relief, notwithstanding that a violation of section 337 has been found.
3. (a) Assuming the issuance of an exclusion order, what is the appropriate amount of the bond during the Presidential review period.

(b) Assuming the issuance of cease and desist orders, what is the appropriate amount of the bond for temporarily permitting the activity otherwise prohibited by the cease and desist orders during the Presidential review period.

We discuss each in turn.

1. REMEDY

Once the Commission determines that a violation of section 337 exists, it must consider the question of remedy. Under the statute, the Commission may issue an exclusion order, a cease and desist order, or both, depending on the circumstances. 19 U.S.C. § 1337(d)-(f). There are two types of exclusion order: a general exclusion order and a limited exclusion order.

A general exclusion order instructs the Customs Service to exclude from entry all articles which infringe the involved patent, without regard to source. Thus a general exclusion order applies to persons who were not parties to the Commission's investigation and, indeed, to persons who could not have been parties, such as persons who decide to import after the Commission's investigation is concluded.

A limited exclusion order instructs the Customs Service to exclude from entry all articles which infringe the involved patent originating from a named person who was a party to the Commission investigation.

A cease and desist order is an order to a person who was a party to the Commission investigation to cease its unfair acts. Unlike an exclusion order, it is enforced by the Commission, through the courts, not by the Customs Service.

A general exclusion order is the broadest type of relief available from the Commission. Because of its considerable impact on international trade, extending beyond the parties and articles involved in the investigation, more than just the interests of the parties is involved. Therefore, the Commission exercises caution in issuing general exclusion orders and requires that certain conditions be met before one is issued. These conditions were outlined by the Commission in Certain Airless Paint Spray Pumps, Inv. No. 337-TA-90, 216 USPQ 465 (ITC 1981), where the Commission stated that it would "require that a complainant seeking a general exclusion order prove both a widespread pattern of unauthorized use of its patented invention and certain business conditions from which one might reasonably infer that foreign manufacturers other than the respondents to the investigation may attempt to enter the U.S. market with infringing articles". 216 USPQ at 473.

With regard to the element of "a widespread pattern of unauthorized use of its patented invention," the Commission stated:

Among the evidence which might be presented to prove a widespread pattern of unauthorized use of the patented invention would be:

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

216 USPQ at 473 (footnote omitted).

With regard to the element of "business conditions from which one might reasonably infer that foreign manufacturers other than the respondents to the investigation may attempt to enter the U.S. market with infringing articles," the Commission stated:

Among the evidence which might be presented to prove the "business conditions" referred to above would be:

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

216 USPQ at 473.

Whether these conditions have been satisfied must be examined in every case where the complainant has requested a general exclusion order. Whether to issue a general exclusion order is based on an examination of:

- (1) the evidentiary record,
- (2) the written submissions on remedy, public interest, and bonding, and
- (3) any matters of which the Commission may take administrative notice.

The Commission has on several occasions refused to issue a general exclusion order (as opposed to a limited exclusion order) after making this inquiry. See, e.g., Certain High Intensity Retroreflective Sheeting, Inv. No. 337-TA-268, USITC Pub. No. 2121 (September 1988); Certain Dynamic Random Access Memories, Components Thereof and Products Containing Same, Inv. No. 337-TA-242, USITC Pub. No. 2034 (November 1987).

Markem maintains that a general exclusion order should issue. Markem Remedy Brief, pp. 1-2, 7-11, Attachment A; Markem Remedy Reply Brief, pp. 1-5. Alternatively, Markem argues that if the Commission does not issue a general exclusion order, it should issue a limited exclusion order. Markem has also requested that the Commission issue cease and desist orders against the three domestic respondents (an importer and two distributors). Markem Remedy Brief, pp. 1-2, 11-13, Attachment B; Markem Remedy Reply Brief, pp. 5-8.

For the reasons discussed below, we determined to issue only a limited exclusion order in this case. We believe that the facts

of this case do not warrant the issuance of a general exclusion order or cease and desist orders.

a. General Exclusion Order/Limited Exclusion Order

Although Markem argues that a widespread pattern of sales of infringing hot-ink rotary coders exists, an examination of the evidence shows that the only coders shown to be infringing were those manufactured by respondent Dato Pack Europa. Markem alleges that there are four other companies manufacturing rotary coders that "would infringe if imported": Maky, Sermatec, Overprint Packaging Sales, Ltd., and BARBAN.

We believe that Markem has failed to make out its case. First, as Markem concedes, none of these rotary coders has yet been imported into the United States, nor does it appear that they are likely to be imported in the near future. Second, many of the exhibits Markem relies on to show at least potential infringement by Maky, Sermatec, and Overprint Packaging were withdrawn from the evidentiary record. Markem did not attempt to reintroduce these exhibits in its written submission on remedy, public interest, and bonding and thus neither Markem nor the Commission may rely on them. As to BARBAN, while the printer in Attachment 3 of Markem's Remedy Brief does resemble the claimed invention, it is not possible to conclude from the information of record that it would infringe if it were imported.

We therefore believe that Markem has failed to prove that there are numerous manufacturers producing infringing rotary coders.

Markem's reference to the several affiliates of respondents which allegedly manufacture or sell the specific accused products does not help Markem's argument for a general exclusion order, since the devices originate from Dato Pack Europa, a named respondent, and in any event such imports would be covered by a limited exclusion order.

Markem similarly refers to infringement actions in France and Italy based on its corresponding European patent. But these actions also involve affiliates of Dato Pack Europa and its affiliates. These firms would likewise be covered by a limited exclusion order as related companies.

From the foregoing, it is clear that Markem has failed to establish the first prong of the Spray Pumps test for the issuance of general exclusion orders. This is enough to result in denial of Markem's request for a general exclusion order. We will issue a limited exclusion order instead.

As to the second prong of the Spray Pumps test, while Markem has established that a U.S. market exists for its rotary coders and has asserted that there are non-exclusive distributorship for rotary coders, some of these are named respondents who are distributors of the accused devices and there is only limited information on the others. It is difficult to conclude that foreign manufacturers other than respondents may attempt to enter the U.S. market, at least in the near future. We believe that Markem has failed to establish the second prong of the Spray Pumps test as well.

b. Cease and Desist Orders

With regard to the issuance of cease and desist orders, the Commission normally issues these when the circumstances indicate that the respondents have in U.S. inventory a commercially significant amount of the accused product which they can sell, thus undercutting the effect of any exclusion order. Certain Crystalline Cefadroxil Monohydrate, Inv. No. 337-TA-293, USITC Pub. 2391 (Commission Decision of March 15, 1990). While Markem has cited instances where the Commission has issued cease and desist orders where the evidence, though not specific, supported that conclusion, those circumstances do not exist here. The record indicates that the known inventory in November and December of 1990 was small compared to Markem's sales. We have therefore determined not to issue cease and desist orders in this case.

2. THE PUBLIC INTEREST

Prior to issuing relief, the Commission is required to consider the effect of such relief on the public health and welfare, competitive conditions in the U.S. economy, the production of like or directly competitive articles in the United States, and U.S. consumers. 19 USC 1337(d). Markem and the IA argue that the issuance of relief in this case would have no adverse impact on the public interest in this case. We agree with Markem and the IA that the statutory public interest factors do not preclude issuance of relief in this investigation.

3. BONDING

Markem and the IA urge that the bond during the 60-day Presidential review period should be set at 100 percent of the entered value of the imported rotary coders, citing an alleged Commission practice of using a 100 percent bond when there is insufficient price information to make a price comparison between the infringing goods and those of the domestic industry or, conversely, where there is information but there is no established price structure. Markem Remedy Brief, pp. 16-19. Markem does, however, refer to price information which permits it to make a comparison of the prices of the importer with those of Markem and to calculate that a 52 percent bond would be necessary to offset the price advantage enjoyed by the infringing imports.

We find that the temporary importation bond be set at 52 percent of entered value of the articles concerned. The purpose of the temporary importation bond is to offset any competitive advantage the infringer may have. The Commission usually does this by looking to the apparent difference in price enjoyed by the infringing imports at the appropriate level of competition. See Cefadroxil, supra. Here, it would appear that the appropriate level of competition is that between the importer and the domestic manufacturer.

There is some evidence, cited by both Markem and the IA, of what this price differential is in dollars and as a percent of the importers' sales price. As a matter of convenience for the Customs Service, the percent of importers' sales price would be used as the

percent of entered value that the Commission frequently uses to express the bond amount, even though the entered value may be less than the importer's sales price, with the result that use of the importer's sale price percentage may result in the advantage enjoyed by the importer not being completely offset.

In the absence of information on the entered value prices, this imperfection can be completely remedied by using the dollar figure differential instead of a percentage of entered value as the bond amount. This apparently would cause problems for the Customs Service and is not the usual practice of the Commission. At least a partial compensation can be effected, however, by computing the percent sales price differential on the basis of the lowest price quoted by the importer unless that lowest price is anomalous. A set figure of 100 percent, would, under the circumstances here, appear to be unjustified.


In view of the foregoing, we find that the bond in this case during the Presidential review period be set at 52 percent of the entered value of the articles involved.

CERTAIN ROTARY PRINTING APPARATUS USING HEATED
INK COMPOSITION, COMPONENTS THEREOF, AND SYSTEMS
CONTAINING SAID APPARATUS AND COMPONENTS

337-TA-320

CERTIFICATE OF SERVICE

I, Kenneth R. Mason, hereby certify that the attached VIEWS OF THE COMMISSION was served upon Juan Cockburn, Esq. and the following parties via first class mail, and air mail where necessary on June 24, 1992.


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PUBLIC VERSION

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

In the Matter of)
)
CERTAIN ROTARY PRINTING APPARATUS)
USING HEATED INK COMPOSITION,)
COMPONENTS THEREOF, AND SYSTEMS)
CONTAINING SAID APPARATUS AND)
COMPONENTS)
)

Investigation No. 337-TA-320

U.S. OFFICE OF THE SECRETARY OF COMMERCE
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INITIAL DETERMINATION

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HISTORY OF THE CASE

On October 23, 1990, Markem Corporation filed a complaint with the U.S. International Trade Commission alleging violation of Section 337 of the Tariff Act of 1930 as amended (19 U.S.C. § 1337) in connection with the importation of certain rotary printing apparatus. An amendment to the complaint was filed on November 14, 1990. The Commission, acting on this complaint, on November 20, 1990 issued a notice of investigation that was published in the Federal Register on November 28, 1990. (55 Fed. Reg. 49437.) The notice instituted an investigation to determine:

whether there is a violation of subsection (a)(1)(B)(i) 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 rotary printing apparatus using heated ink composition, components thereof, and systems containing said apparatus and components thereof, by reason of alleged infringement of claims 1, 2, 3, 4 or 6 of U.S. Letters Patent 4,559,872, and whether there exists an industry in the United States as required by subsection (a)(2) of section 337.

A hearing was held by an administrative law judge under the Administrative Procedure Act (5 U.S.C. § 557).

Complainant Markem Corporation is located in Keene, New Hampshire. Respondent Dato Pack Europa, S.A., of Barcelona, Spain, manufactures the rotary coders that complainant alleges infringe the '872 patent and exports them to the United States. The other respondents are Franklin Manufacturing Corp., located in Norwood, Massachusetts; Professional Sales Associates, Inc., located in Lake Bluff, Illinois; Dato Coding Systems, Inc., located in Ft. Lauderdale, Florida; and Imaje, S.A., located in Bourg Les Valence, France.

The Commission investigative attorney, Office of Unfair Import Investigations, represents the Commission as an independent party.

JURISDICTION

The Commission has subject matter jurisdiction over this case. The scope of the investigation is limited to alleged unfair acts in connection with the importation of certain rotary printing apparatus using heated ink compositions, components thereof, and systems containing said apparatus and components into the United States or the sale of such imported rotary printing apparatus. This falls within the subject matter jurisdiction of § 337.

The Commission has personal jurisdiction over all of the parties. All of the parties entered appearances and actively participated in the hearing.

Imaje is a French corporation that owns almost a 100% interest in Dato-Pack Europa, S.A., the respondent that manufactures and exports to the United States the rotary coders in issue. Imaje itself neither makes nor exports the products in issue to the United States.

ISSUES

The issues to be decided are (1) whether claims 1-4 and 6 of the '872 patent are valid, (2) whether any respondent has infringed any of these claims if they are valid, and (3) whether there is a domestic industry practicing the claims of the '872 patent in issue.

An issue of fraud on the Patent and Trademark Office (PTO) was raised for the first time in respondents' pre-trial memorandum, too late to allow complainant a fair opportunity to defend against this allegation. This issue was not tried in this case.

Two other defenses raised by respondents under Sections 101 and 112 of the Patent Act will not be considered here. A motion by respondents to add these affirmative defenses was not filed until the middle of the trial, too late to allow complainant adequate time to prepare a defense on these issues.

I would like to thank all of the parties for stipulating many of the facts that were not in controversy in this case. This shortened the hearing and made it possible to write an initial determination of reasonable length.

VALIDITY OF THE '872 PATENT

The inventor named in the '872 patent, Andrew G. Perra, Jr., filed an application for a patent on his printing apparatus using heated ink composition on April 30, 1984. U.S. Patent No. 4,559,872 was issued on December 24, 1985, and Mr. Perra assigned the patent to Markem Corporation, the complainant here. (Markem Ex. 2.)

There is a statutory presumption that the '872 patent is valid. 35 U.S.C. § 282. Respondents have the burden of proving by clear and convincing evidence that each asserted claim of the patent is invalid. Hybritech, Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1375, 231 U.S.P.Q. 81, 87 (Fed. Cir. 1986), cert. denied, 480 U.S. 947, 107 S.Ct. 1606 (1987).

The subject matter of the '872 patent is a rotary coder. Rotary coders are printing devices used to print number or letter codes on strips of paper that are attached to packaging or on the packages themselves. The machines are purchased by manufacturers who want to mark their own products before sale, to identify the batch and lot numbers of the product, for example, or the date it was made, or the price. The machines must be sturdy, long-lasting, and simple to use. There is a large market for this product.

The patent abstract describes the invention as a simple printing apparatus for use with ink compositions that are solid at normal room temperatures but become liquid at elevated temperatures. The essential parts of the apparatus include a rotary printing member with one or more printing elements, an inking roll, and a one-piece, wrap-around radiant heater block

for maintaining the inking roll and printing elements at temperatures high enough to keep the ink liquid while the device is printing.

The patent specification points out the advantages of using solid ink that becomes liquid when it is heated. The liquid ink provides good quality printing that dries almost immediately, while the inking rolls can be changed when they are cold without spilling any ink.

The use of heated ink in printers was not new in 1984. Inking rolls in the prior art were heated by various methods. In one method, a heated shaft was inside the inking roll. In another, part of the inking roll was enclosed in a curved metal heating block in which heating devices were embedded. After the ink was hot, it was transferred to the printing element, which was kept hot to prevent the ink from drying before the printing took place.

Various heating methods also were used to heat the printing element. In all the prior art devices described in the '872 patent specification, however, one heating means was used to heat the inking roll and another heating means was used to heat the printing element.

Several problems with the prior art devices were identified in the patent specification. The printing element generally was a moving part. When the printing element was a cyclical reciprocal arm, wires could be connected to the reciprocal arm from a heating source, but when the printing element was a rotary printer, brushes and slip rings (or their equivalent) had to be used instead of direct wire connections. These were complex and expensive, and frequently failed. (Markem Ex. 2, col. 2, lines 33-58; Tr. 95, 238.)

Mr. Perra's invention avoided these problems by using a single external heating means on his rotary coder to heat the inking roll and the printing roll by radiation. The heating means enclosed but did not touch the inking

roll or the printing roll. The preferred embodiment of Mr. Perra's invention as set forth in the patent specification discloses a unitary radiant heating means at least partially surrounding both the rotary printing member and the inking roll. This one-piece substantially U-shaped heating block was made of thermally conductive material (Mr. Perra used aluminum). One or more electrical heating elements were embedded in it. The closed end of the heating block surrounded the inking roll, and the open end partially surrounded the rotary printing member. The interior surface of the U-shaped block was curved around the inking roll and the printing member.

After the patent application was filed in 1984, the patent examiner rejected the original claims over prior art references. The applicant then revised the claims to overcome the rejection, and argued that his revised claims could be distinguished from the prior art references. Claims 1-6 then were allowed and the patent was issued. (Dato Pack Phys. Ex. FF.)

Claims 1-4 and 6 of the '872 patent, the claims in issue, are as follows:

1. A printing apparatus comprising:

a rotating printing member having at least one printing element thereon;

an inking roll for inking the printing element, said inking roll having a porous construction and being impregnated with an ink composition of the type which is solid at normal room temperatures and is rendered liquid or flowable at elevated temperatures; and

radiant heating means for maintaining the inking roll and the printing element on the printing member at elevated temperatures, said radiant heating means comprising a one-piece, substantially U-shaped member made of a solid block of thermally conductive material with one or more electrical heating elements therein, said U-shaped member having its closed end surrounding the inking roll and its open end partially surrounding the printing member.

2. A printing apparatus as claimed in claim 1, wherein the U-shaped member is provided with first and second cylindrically curved interior surfaces which conform closely to the outermost surfaces of the inking roll and printing member, respectively.
3. A printing apparatus as claimed in claim 1, wherein said thermally conductive material comprises a metallic material.
4. A printing apparatus as claimed in claim 1, wherein said thermally conductive material comprises aluminum.
6. A printing apparatus as claimed in claim 1, further comprising a backup roll for supporting a web to be printed in rolling contact with the printing member.

CONSTRUCTION OF THE PATENT TERMS

The outcome of this case depends upon the construction of certain words and phrases in independent claim 1 of the patent. All of the other claims are dependent from claim 1.

The construction of words and phrases in a patent claim is a matter of law. Although the Federal Circuit has held that a factual finding as to the meaning of a disputed term in a claim must be made, McGill, Inc. v. John Zink Co., 736 F.2d 666, 672, 221 U.S.P.Q. 944 (Fed. Cir.), cert. denied, 469 U.S. 1037 (1984), in later cases the Federal Circuit has held that determination of the scope of the claims is a matter of law. Texas Instruments, Inc. v. United States International Trade Commission, 805 F.2d 1558, 231 U.S.P.Q. 833, 834 (Fed. Cir. 1986).

There are a number of rules for claim construction. (See Patents, Donald S. Chisum, Vol. 4, Section 18.01.) Most of the rules of construction have been developed in the case law, but some are in the Patent Act (for example, 35 U.S.C. § 112, para. 6, relating to a means-plus-function claim). Where the Patent Act requires that a claim be construed in a certain way, the

statute will be followed even if it conflicts with another rule of construction.

A patent claim must be interpreted in the same way for determining validity as for determining infringement. White v. Dunbar, 119 U.S. 47 (1886); W.L. Gore & Assoc. v. Garlock, Inc., 842 F.2d 1275, 1279, 6 U.S.P.Q.2d 1277, 1280 (Fed. Cir. 1988). The claims first must be construed without reference to the accused device, and then applied to the accused device to determine infringement. SRI International v. Matsushita Elec. Corp. of America, 775 F.2d 1107, 1118, 227 U.S.P.Q. 577, 583 (Fed. Cir. 1985); Lemelson v. United States, 752 F.2d 1538, 1549, 224 U.S.P.Q. 526, 532 (Fed. Cir. 1985).

In interpreting the scope of the claims, claims should be construed, where possible, to sustain their validity, ACS Hosp. Systems, Inc. v. Montefiore Hosp., 732 F.2d 1572, 1577, 221 U.S.P.Q. 929, 932 (Fed. Cir. 1984), even if that results in a finding of non-infringement. Carman Industries, Inc. v. Wahl, 724 F.2d 932, 220 U.S.P.Q. 481, 485, 489 (Fed. Cir. 1983).

Claims can be construed in light of the prior art. SRI International v. Matsushita Elec. Corp. of America, 775 F.2d at 1118, 227 U.S.P.Q. at 583. When it is possible to construe a claim narrowly in order to avoid finding that it is obvious in light of the prior art, it should be construed narrowly. But a claim cannot be twisted "like a nose of wax" to make it include something other than what its words express. White v. Dunbar, 119 U.S. at 51.

One document that must be considered in claim construction is the file history of the patent. Graham v. John Deere Co., 383 U.S. 1, 31-34, 148 U.S.P.Q. 459, 472-73 (1966). Claim construction also requires an examination of the patent specification and sometimes other claims of the patent, as well as the circumstances surrounding the patent at its inception

(such as the meaning given to words by the inventor at the time that the application was filed, or his description of his invention). Lemelson v. United States, 752 F.2d at 1549, 224 U.S.P.Q. at 532. Other factors also may be important, such as the understanding of the words in the claim or the patent specification by one with ordinary skill in the art at the time the patent is issued.

Under the doctrine of equivalents, a product sometimes can be covered by a claim even if it does not fall within the literal meaning of a claim if it does the same work in substantially the same way and accomplishes substantially the same result as the patented product.

Under the doctrine of file wrapper estoppel (or prosecution history estoppel), however, a claim cannot be expanded under the doctrine of equivalents to recapture subject matter deliberately surrendered during the course of the proceeding in the Patent and Trademark Office (PTO) in order to obtain allowance of the claim.

Following one rule of construction may result in an interpretation of a word or a phrase in a claim that conflicts with an interpretation of a claim under another rule of construction. Depending on the facts in each case, certain rules of construction become more important than others. For example, in a means-plus-function claim, the Patent Act (35 U.S.C. § 112, para. 6) requires that the means must be either the means set forth in the specification or means equivalent to those set forth in the specification. This restricts the construction of the language in claim 1 that describes the radiant heating means, regardless of what the inventor or the person with ordinary skill in the art reading the claim would have thought the words in

the claim meant. The means set forth in the patent specification (or equivalent means) limit the scope of the means set forth in the claim.

One of the most important criteria in construing the language of a claim 40 years ago was fairness to the reader. A patent, which is a monopoly for a limited time, was supposed to give a clear warning to the reader of what the claims covered. Section 112 of the Patent Act still requires that the specification include claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention, but the same section makes an exception for the means-plus-function claim. The requirement that a clear line be drawn in the claim between what infringes and what does not infringe does not apply to the means-plus-function claim.

No patent claim today can be relied upon to give a clear warning to the reader of exactly what the claim covers. Where a mandatory rule of construction exists, such as file wrapper estoppel, or the doctrine of equivalents, or where a judge defines some new rule of construction as mandatory, there is no way for one with ordinary skill in the art to read only the patent claim and be sure that he knows what it means. As the courts have developed new rules of construction and equitable theories altering the scope of the claim, determining what a patent claim means has become the exclusive province of the courts.

If one is not construing a claim in a manner required by the statute, or by the doctrine of equivalents or by the doctrine of file wrapper estoppel (all mandatory rules of construction), the other rules of construction are optional. One can select which rule to follow, and distinguish conflicting rules as less important in this particular case. The optional rules are no more than a list of factors considered by various courts in applying common

sense to determine the meaning of a word or a phrase in a claim. Ultimately whatever court is last to decide what a claim means will determine the scope of the claim. The scope of the claim is now considered to be an issue of law.

In this case, unless another construction of a claim is required, words in a claim will be given their ordinary meaning, unless the inventor gave the words a different meaning at the time the application was filed. Envirotech Corp. v. Al George, Inc., 730 F.2d 753, 759, 221 U.S.P.Q. 473, 477 (Fed. Cir. 1984). The meaning that the inventor gives to his words at the time of the patent application cannot be changed to conform to subsequent events. Lear Siegler, Inc. v. Aeroquip Corp., 733 F.2d 881, 888-89, 221 U.S.P.Q. 1025, 1031-32 (Fed. Cir. 1984).

The following language in claim 1 requires construction:

said inking roll...being impregnated with an ink composition of the type which is solid at normal room temperatures and is rendered liquid or flowable at elevated temperatures; and

radiant heating means for maintaining the inking roll and the printing element on the printing member at elevated temperatures, said radiant heating means comprising a one-piece, substantially U-shaped member made of a solid block of thermally conductive material with one or more electrical heating elements therein, said U-shaped member having its closed end surrounding the inking roll and its open end partially surrounding the printing member.

The term elevated temperatures is not part of the description of the radiant heating means in the means-plus-function part of claim 1. It is part of the description of the inking roll in claim 1, and it is part of the description of the function under the radiant heating means-plus-function part of claim 1. Since "elevated temperatures" does not appear in the means part of claim 1, it need not be construed as limited to what is disclosed in the patent specification or the equivalent. The term "elevated temperatures" is a relative term, however, and it must be understood in the context of the patent

specification. The temperature must be high enough to perform the function of the radiant heating means disclosed in the patent specification. This function is to heat the inking roll to a temperature hot enough to make the ink flow, so that the ink can be picked up by the printing roll. The printing roll has to be hot enough so that the ink will not solidify before the device prints on the tape or package under it.

Nothing in claim 1 or the patent specification requires that the temperatures of the inking roll and the printing roll be the same or that their temperatures be sustained at one level to accomplish their function. In col. 9, the patent specification states that the inking roll and printing roll are at different temperatures.

The specification indicates that the entire one-piece heater block is kept at a uniform heat. In order to provide "efficient and uniform heating at the surfaces" of the two rolls (i.e., uniform heat will be radiated from the heater block to the surfaces of the two rolls), the distance between the heater block and the two rolls is relatively small and evenly spaced. This evenly-spaced gap is achieved by the U-shaped cylindrically curved interior surfaces of the heater block which conform closely to the peripheral surfaces of the rolls. (See Markem Ex. 2, cols. 4-5.)

The phrase radiant heating means is in the means-plus-function part of claim 1. The radiant heating means is defined in the claim itself as comprising a one-piece, substantially U-shaped member made of a solid block of thermally conductive material with one or more electrical heating elements therein.

The radiant heating means must include the elements set forth in claim 1. Since claim 1 is a means-plus-function claim, the means also must be the same

as the means set forth in the specification or the equivalent of those means.

The function of the radiant heating means must be the same as the function set forth in claim 1 unless the doctrine of equivalents is applicable, and an equivalent function to that claimed is found.

The function of the radiant heating means in claim 1 is to maintain the inking roll and the printing element on the printing member at the elevated temperatures necessary for each to function. (Markem Ex. 2, col. 12, lines 1-7; col. 3, lines 4-13; col. 9, lines 40-52.)

Respondents ask that the term radiant heating be defined as it is defined in thermodynamics: a source that emits infrared electromagnetic waves. (See Commission Investigative Attorney Ex. 46, at 367-368, Ex. 48, at 592-593.) Complainant (Markem) takes the position that radiant heating was used in the '872 patent in a simpler sense.

Radiant heating is not defined in the patent or the file wrapper, but one with ordinary skill in the art could look at the drawings in the patent to see how the heat was transferred. The drawings show that the objects to be heated are located a short distance away from the heat sources but are not connected to them. The drawings and the description in the specification show that the heating block partially surrounding the inking roll and the printing roll heated them by radiating heat across a narrow gap or air space. The drawings suggest that the heating block would heat the air next to it. One with ordinary skill in the art would understand that the hot air could circulate, carrying heat by convection to other parts of the device. The drawings show that some heat may be conveyed by conduction from the heating block to the printing roll through the shaft holding the printing roll, although it is not

clear how much heat would be transferred by conduction because the material in the shaft is not specified.

Radiant heating will be given the meaning that the term would have had to a person with ordinary skill in the art at the time the patent application was filed. One with ordinary skill in the art in 1983-1984 would have had the equivalent of a high school education and extensive practical experience in manufacturing, operating, repairing or designing printers that are used as coders. (Tr. 81-87, 676-688.) He would have understood from his own experience that heat can radiate from one object to another without the objects touching, just as a radiator warms objects close to it.

In the McGraw-Hill Dictionary of Scientific and Technical Terms, Fourth Edition, a distinction is made between heat radiation, convection and conduction. Heat radiation is defined as the energy radiated by solids, liquids, and gases in the form of electromagnetic waves as a result of their temperature. Heat convection is defined as the transfer of thermal energy by actual physical movement from one location to another of a substance in which thermal energy is stored. Heat conduction is defined as the flow of thermal energy through a substance from a higher-temperature region to a lower-temperature region.

Some experts in heat transfer describe all heat transfer as occurring by means of conduction or radiation. Heat can be transferred by radiation or electromagnetic waves, for example from a radiator to a nearby object, with or without air between the radiator and the nearby object. Heat also can be transferred more slowly by conduction through the molecules of air between the radiator and the nearby object. The heat is transferred first from the radiator to the air molecules next to it, then through the air by conduction

from one molecule to another as the air molecules move about and bump one another, until they reach the object near the radiator. (Tr. 612-613.)

Subsequent movement of a volume of heated air is known as convection, which is considered by some to be a separate method of heat transfer. (See Dato Pack Ex. 80, 1-5.)

Theoretical definitions of heat transfer are for the most part irrelevant to the '872 invention. When he testified at the hearing, Mr. Perra gave "radiant heating" its common meaning, defined in terms of what it did, not in terms of what caused it to do this. Mr. Perra was not thinking about how heat was transferred. He testified that "radiant heating" means that heat will radiate from a heat source like a radiator to an object a short distance away. (Tr. 119, 176-178.) It did not matter how this happened.

The Perra invention was a practical one. It simplified the heating system used in earlier rotary coders and improved the means of heating the inking roll and the printing roll by separating them from the heat source, and heating them primarily by radiation. He eliminated the complicated brushes and slip rings that had been used to heat a rotary printer in favor of a simple one-piece heating block that partially surrounded and heated the inking roll and the printing roll.

The radiant heating means-plus-function part of claim 1 is construed as covering radiant heating means (1) that are the same as or the equivalent of the means described in the specification in which heat is transferred by radiation, and (2) that perform the same function as set forth in claim 1 (maintaining the inking roll and the printing element on the printing member at elevated temperatures).

Heat may be transferred by convection and by conduction as well as by radiation and still be covered by claim 1. Respondents argue that the doctrine of file wrapper estoppel requires that the term "radiant heating means" in claim 1 be construed as requiring the use of radiant heating means alone, pointing out that in the file wrapper the applicant distinguished his device from prior art devices that used conduction and convection as heating means in order to overcome the examiner's rejection of the original claims.

After the examiner rejected the original claims 1-20, the applicant substituted revised claims and the revised claims were allowed. Original claim 1 had been rejected in view of the '707 patent to West. After revising claim 1, the applicant distinguished his invention from the device disclosed in the West patent on several grounds. One particular point is relied upon by respondents here. (Dato Pack Phys. Ex. FF at 50). The applicant stated:

West points out that the rollers of the inking train are heated by an up-draft of warmth (i.e., by convection) from the heating elements 33 (col. 5, lines 11-13), so it is obvious that these rollers are not required to be heated by radiant heat as is the inking roller of the present invention.

The applicant was not saying that his new device used only radiant heat; he was pointing out that West did not use radiant heating means to heat the inking rolls (which are not close to the quartz heating elements), while the '872 device did. The inking roll in the '872 device was surrounded by a radiant heater. This part of the file wrapper does not estop the patentee from arguing that a device that heats with some other form of heat transfer in addition to radiation is covered by claim 1.

The applicant also distinguished the Andrews '886 patent from his device:

...the use of the term "heated chamber," by Andrews ..., together with the need for an enclosure to confine the heated air, clearly implies that the heating of the cylinders takes place by convection, as in a conventional oven, rather than by radiation. Such a disclosure can hardly be taken as a suggestion to employ a radiant heating device.

Again, the applicant did not say that his invention used only radiant heat. He distinguished Andrews as heating by convection, using an enclosed heated chamber similar to an oven, while the '872 device has a solid massive heating element that heats what it surrounds by radiation. (Dato Pack Phys. Ex. FF at 51-52.)

File wrapper estoppel does not require a construction of the phrase "radiant heating means" as meaning that the device could use only radiant heating. The device as disclosed in the '872 patent specification drawings heated by radiation, convection and conduction. Heat was conveyed to the nearby printing roll by radiation and conduction, but the heat also warmed the air between the printing roll and the heater, and the warm air would tend to circulate around the other parts of the printer. The device could print right-side-up or upside-down, and convection could carry warm air currents in any direction. Professor Richter pointed out that in the absence of a vacuum, there can be no radiant heat on the Earth without associated convection. (Tr. 613-614.)

In claim 1 there must be a radiant heating means and it must comprise a one-piece, substantially U-shaped member made of a solid block of thermally conductive material. Each element of this phrase must be read in the context of the whole phrase. Then the phrase will be restricted to what is disclosed or the equivalent of what is disclosed in the patent specification.

While the patent specification implies that some heat is transferred by conduction and convection, claim 1 describes only the radiant heating means. The radiant heating means of claim 1 must be the same or the equivalent of the radiant heating means disclosed in the patent specification, but claim 1 does not require conductive or convective heating means equivalent to those depicted in the drawings of the patent. Their presence is irrelevant.

The term one-piece is defined in the context of a "one-piece solid block of thermally conductive material". Although a heating block may be physically in one piece, i.e., bound together in some way so that it does not fall apart, it will not be construed as being one piece as used in claim 1 unless it is part of a one-piece solid block of thermally conductive material.

The term solid block is construed as not requiring an entirely solid block, because the specification indicates that heating devices are inserted into this "solid" block. The term "solid block" is construed as meaning a substantially solid piece of material. The critical thing about this solid block is that it must be made of thermally conductive material.

The term thermally conductive material is defined as any material that will readily conduct heat. From the use of the term "thermally conductive material" in the patent specification, it is clear that the inventor did not contemplate that an insulator, a poor thermal conductor, would be used as the thermally conductive material. The purpose of the radiant heater disclosed in the specification was to heat the objects that it surrounded as rapidly as possible without using wires or other connections to these objects, thereby simplifying the heating means. The file history and the specification emphasize the advantages over the prior art of the one-piece solid block in which the whole block heats rapidly and radiates heat to the objects it

surrounds but does not touch. The term "thermally conductive material" is construed as it is used in the patent specification, as referring to any material that is as good a conductor of heat as aluminum, or has substantially the same conductivity as aluminum.

The specification states that "any suitable thermally conducting material" may be used for the heater block, although a metallic material such as aluminum is preferred. (Markem Ex. 2, col. 4, lines 66-68.) The conductive material need not be aluminum or a metal. A material like aluminum is a ready conductor of heat. On the other end of the scale, even an insulator, which is a very poor conductor, will conduct some heat over time under certain circumstances. Because an insulator is not a good conductor of heat, it is not a thermally conductive material as that term is used in claim 1 and the patent specification. In between an insulator and a good conductor like aluminum are numerous materials at different grades of conductivity. (Tr. 268-272.) Unless a material is a good conductor of heat (as good as aluminum, or even not quite as good as aluminum, as long as it has substantially the same conductivity as aluminum) it will not be covered by claim 1 because it is not the equivalent of what is described in the specification.

Complainant argues that the rule of claim differentiation precludes defining the phrase "thermally conductive material" in claim 1 as including only those materials having equivalent thermal conductivity to aluminum.

Under the rule of claim differentiation, one claim can be used to construe another, on the theory that the inventor did not intend to have two claims say the same thing. Claim 1 is broader than dependent claims 3 and 4; it refers to "thermally conductive material". Claim 3 limits the thermally

conductive material to a metal. Claim 4 limits the thermally conductive material to aluminum. Markem argues that claim 4 just repeats claim 1 if claim 1 is limited to covering only a material with the same conductivity as aluminum (or substantially the same conductivity as aluminum).

The Federal Circuit has held that in a means-plus-function claim, the claim must be construed as restricted to what is disclosed in the specification or the equivalent, even if there is a conflict with the claim differentiation rule. Laitram Corp. v. Rexnord, Inc., ___ F.2d ___, 19 U.S.P.Q.2d 1367, 1371 (Fed. Cir. 1991). This requires that claims 1, 3 and 4, which are means-plus-function claims, be limited to the equivalent of what is described in the specification. An equivalent of aluminum in the context of thermal conductivity is any material with substantially the same conductivity as aluminum. The means-plus-function rule does not quite make claim 4 redundant, because claim 4 requires that aluminum be used, not a material with substantially the same conductivity. But even if the claims were made redundant by the rule, the means-plus-function rule must be used even though it conflicts with the claim differentiation rule.

The term U-shaped cannot be read as requiring a perfect U-shape because this is not what is disclosed in the patent specification. Figure 1 is a drawing of an inverted undulating U that generally encircles the inking roll on the top and partially encircles the printing elements on the bottom of the drawing. The U-shaped heating block is open at one end. The inking roll is in a smaller circle in the closed end of the U, and the printing roll is in the larger circle in the open end of the U. Part of the printing roll surface is exposed at the open end of the U so that it can print on the tape or other material running under or over it. The U has curves on the inside surface

following the shape of the inking roll and the printing roll. As used in claim 1, "U-shaped" is construed as the shape shown in Figure 1 or an equivalent shape.

OBVIOUSNESS

Section 103 of the Patent Act provides that a patent may not be obtained 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. (Respondents did not argue that the claims in issue of the '872 patent were anticipated under Section 102.)

In Graham v. John Deere Co., 383 U.S. at 17-18, 148 U.S.P.Q. at 467, the U.S. Supreme Court set forth the following test for obviousness:

Under §103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved Such secondary considerations as commercial success, long felt but unresolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.

The issue under Section 103 is whether the claims in issue in the '872 patent would have been obvious at the time of the invention to one with ordinary skill in the art. The precise time of the invention is not an issue in this case. Mr. Perra conceived the idea in May 1983, built a prototype during the summer of 1983, and filed his patent application in April 1984. (Tr. 94-101; Markem Exs. 5, 13.)

The level of ordinary skill in the pertinent art must be defined. The pertinent art includes rotary printing devices and other printing devices that print numbers or letters on packaging or tapes that can be applied to products or packages. One with ordinary skill in the art at that time would have had

the equivalent of a high school education and extensive practical experience with printers that are used as coders, including designing, manufacturing, operating, or repairing them. (See Tr. 81-87, 676-688.)

THE PRIOR ART

Respondents rely on the following prior art:

1. Japanese Patent Publication No. 57-129650 and its English translation ("the Japanese '650 patent") (Dato Pack Ex. 68),
2. Belgian Patent Publication No. 547050 and its English translation ("the Belgian '050 patent") (Dato Pack Ex. 70),
3. U.S. Patent No. 3,412,707 to West ("the '707 West patent") (Dato Pack Ex. 60), and
4. The Markem Model 904A rotary coder (Markem Phys. Ex. C).

The Japanese '650 patent and the Belgian '050 patent were not before the '852 patent examiner. Neither the Japanese '650 patent nor the Belgian '050 patent is as pertinent as the prior art that was disclosed to the patent examiner. The West patent and the Markem Model 904A were disclosed to the examiner. (Markem Ex. 5, Information Disclosure Statement filed June 27, 1985).

JAPANESE PATENT PUBLICATION NO. 57-129650

This publication depicts a rotary hot ink printing device with a curved radiant heater substantially surrounding the inking roll. The radiant heater does not surround the printing elements, as in the '872 device. The printing elements are not heated by a separate device. (Tr. 727-28; Dato Pack Ex. 68.) Respondents argue that hot ink technology includes resins having different melting points, so that a resin with a lower melting point could be used in this device and it could print satisfactorily without any separate heating device to heat the printing elements. There was some evidence that devices

similar to that disclosed in this patent were commercially available. (Tr. 788-789.)

The publication discloses an inverted U-shaped radiant heater that heated the inking roll. Unlike the '872 patent device, it has no heater for the printing element. It does not disclose the construction of the radiant heater, while the '872 device is required to be a solid block of thermally conductive material. (Tr. 789, 791; Dato Pack Ex. 68.)

The Japanese publication is less pertinent than the Markem 904A coder that was before the patent examiner and that disclosed a solid U-shaped radiant heater to heat the inking roll. (See below.)

BELGIAN PATENT NO. 547050

The Belgian patent (Dato Pack Ex. 70) discloses an adaptation of a flexographic device. Flexography is a technique invented in the early 1800s that typically used four rollers: a fountain roller mounted above and protruding into a fountain assembly, an intermediate roller called an engraved roller or a transfer roller, a plate cylinder or text drum, and a backup roller. (Tr. 711.)

The device disclosed in the Belgian patent has wax or paraffin (Tr. 716) or "much firmer inks" in the fountain tray. The ink (or paraffin or wax) is heated to maintain the proper consistency. (Dato Pack Ex. 70, translation pp. 2, 5.) The device is used to apply bands of ink to the back of paper to make carbon paper. (Dato Pack Ex. 70, translation p. 2.) The fountain tray containing the ink is heated by heating elements under the fountain tray. The device has a rounded hood surrounding a large portion of the printing element (the plate cylinder) and part of the transfer roller. Heaters on the interior

surface of the hood keep the printing element warm. (Tr. 717, 718; Dato Pack Ex. 70, p. 4.)

There are several differences between the Belgian patent and the '872 device:

(1) The Belgian device differs from the '872 device in that the ink is liquified in a reservoir rather than on the ink roller itself, as in the '872 device. The Belgian device requires an inking roller and a transfer roller to transport ink from the reservoir to the printing roller.

(2) The Belgian device heats the ink by separate heating units underneath the ink reservoir or fountain tray. A hood surrounds and heats the printing element, but not the ink reservoir. In contrast, the radiant heating member of the '872 device partially surrounds the printing member and completely surrounds the inking roll, and heats them both.

(3) The heat sources under the hood of the Belgian device are localized, whereas in the '872 device the heat sources are inserted into one solid thermally-conductive heating block creating a substantially continuous, uniformly heated surface. (Markem Ex. 2; Dato Pack Ex. 70.)

The Belgian patent disclosures are no more pertinent than those in the West patent and U.S. Patent No. 367,886 to Andrews, both of which were before the '872 patent examiner.

THE WEST '707 PATENT

The West patent (Markem Ex. 9, Dato Pack Ex. 60) discloses a hot wax carbon printing device used to make carbon paper. (Tr. 793.) The device disclosed in West is an adaptation of a flexographic machine used to make carbon paper. (Tr. 711, 793; Markem Ex. 9, Fig. 1.) West's device is not capable of printing letters or numbers.

West discloses a hollow radiant heater enclosing quartz heating elements. This heater partially surrounds one side of a printing wheel and is underneath the fountain containing the ink. (Markem Ex. 9, col. 2, lines 53-59; col. 4,

lines 59-75, Fig. 1; Tr. 797.) West distinguishes quartz heating elements from others: "[m]ost other types of heating elements require a considerable time to heat up and continue to radiate heat for long periods after the current is turned off. Such continued radiation damages printing plates" (Markem Ex. 9, col. 4, lines 63-69.) It is clear that West teaches away from the use of solid heaters that can retain heat.

West's radiant heaters do not operate continuously to maintain heat. In West, heating elements initially melt the ink or wax, but once the ink or wax is liquified, a heating element may be turned off, and the ink or wax is kept liquid by updrafts of warm air from another heating element. (Markem Ex. 9, col. 2, lines 53-59; col. 4, lines 71-75; col. 5, lines 10-16.)

Unlike the '872 device, West discloses two radiant heaters rather than one. Neither of West's radiant heaters encloses the inking wheel and the printing element. After startup, parts of the West device are heated solely by updrafts of warm air. (Tr. 712, 715; Markem Exs. 2, 9.) West does not disclose a single radiant heater made of a one-piece solid block of thermally-conductive material that encloses the inking roll and most of the printing roll.

MARKEM MODEL 904A

The 904A coder is a rotary hot ink printer developed by Markem in the early 1980s. The 904A coder has an inking roll located above a printing roll. The inking roll is heated by radiation from a heating block that surrounds it. (Tr. 193-194, 260, 708-709.) A heater inside the printing roll heats the type. (Markem Ex. 11; Markem Phys. Ex. C.) This type of rotary coder is described in the '872 patent (Markem Ex. 2, col. 2, lines 15-32), and the

instruction manual for the 904A (Dato Pack Phys. Ex. HH) is listed in the patent as a prior art reference.

The significant difference between the 904A series and the device disclosed in the '872 patent is that the 904A uses two separate heaters (a solid U-shaped radiant heater for the inking roll, and a heater inside the printing roll), whereas the device disclosed in the '872 patent has a single solid U-shaped radiant heater that surrounds the inking roll and most of the printing roll as well. (Compare Markem Ex. 11, photo 1 with Markem Ex. 2, Fig. 1; Tr. 94.)

None of the references relied on by respondents, alone or in combination, suggests the device disclosed in the '872 patent. Only Markem's 904A coder discloses a solid, inverted U-shaped heating member surrounding the inking roll. The Markem 904A coder does not suggest extending this heating member to surround most of the printing element as well, as claimed in the '872 patent.

SECONDARY CONSIDERATIONS

In Graham v. John Deere Co., 383 U.S. at 17-18, 148 U.S.P.Q. at 467, the U.S. Supreme Court noted that under Section 103:

Such secondary considerations as commercial success, long felt but unresolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.

In this case, secondary considerations support complainant's position that the patent claims in issue are valid:

1. There was a need for the improvement claimed in the '872 patent, though perhaps not long felt. Markem had a customer that manufactured tape dispensing machines used to seal shipping cartons, and the customer wanted a coder that would print information on the tape as the carton was being sealed. The inventor thought that the Markem coders used at that time would be too

bulky and expensive for this use. (Tr. 93-95.) The use of ring-and-brush assemblies to convey heat to a rotary printer made the coders more complex and expensive, and these parts could fail. (Tr. 95-97.) Mr. Perra thought that if he could eliminate the ring and brush assembly, the coder would be less expensive, more reliable, and easier to maintain. He simplified Markem's earlier design by getting rid of the brushes and slip rings used to heat the printing roll, and replaced them with a one-piece aluminum heating block that wrapped around and heated the inking roll and the printing roll by radiation. The device that he conceived is the one disclosed in the '872 patent. (Tr. 94.)

The only prior art rotary coder device in evidence that is equally simple is that disclosed in the Japanese '650 patent publication. (Dato Pack Ex. 68.) This coder does not use any heater for the printing element. There is no one-piece heater covering the ink source and the printing element. Such a device would be limited in the types of ink that could be used without the ink solidifying prematurely on the unheated print roller. (See Tr. 728.)

2. The '872 device had commercial success. Copying is evidence of commercial success, and an indication of nonobviousness. Diversitech Corp. v. Century Steps, Inc., 850 F.2d 675, 679, 7 U.S.P.Q.2d 1315, 1319 (Fed. Cir. 1988).

Complainant's design using a single wrap-around radiant heating block to heat both the printing roll and the inking roll was copied by respondents. The similarities between respondents' Flow 35 and 60 coders and complainant's design are striking. (Tr. 767.) Dato Pack was aware of the '872 patent when its Flow 35 was introduced (Tr. 223-233), and it had the means to copy the heater block disclosed in the '872 patent. (Tr. 919-920.) The General

Manager of Dato Pack, who was the listed inventor in a Spanish patent relating to the heating system of the Flow 35, was unable to identify the designer of the heating system. (Markem Ex. 56 at pp. 24-33, 74-79, 168-172, 175-177.) Dato Pack provided no evidence, such as laboratory notebooks or other documents, of any independent design of the Flow 35 or Flow 60.

The increasing sales of the '872 device were evidence of commercial success. After Markem began to sell the '872 device in 1984, its sales jumped dramatically. (Markem Ex. 64; Commission investigative attorney Ex. 28; Tr. 630-632.) From 1984 to 1990, sales of the '872 coders, as a percentage of Markem's total sales of all types of rotary coders, increased [confidential]. (Markem Ex. 64; Tr. 629-631.)

The patented features of these coders have contributed to their success, and there was no evidence that any factors unrelated to the patent contributed to this success. (Tr. 96-97, 99, 238, 631-632.)

The prior art does not make the claims in issue obvious. The differences between the subject matter sought to be patented in the '872 patent and the prior art are such that the subject matter as a whole would not have been obvious at the time the invention was made (1983-1984) to a person having ordinary skill in the art to which said subject matter pertains (printing devices). Secondary considerations support a finding that the '872 patent is not obvious. Respondents have not proved by clear and convincing evidence that the patent is invalid for obviousness.

INFRINGEMENT OF THE '872 PATENT

Complainant alleged that three of respondents' rotary coders, the Flow 35, Flow 60 and Flow S2, infringed the '872 patent. Complainant has the burden of proving infringement by a preponderance of the evidence.

Respondents stipulated that respondents' Flow 35, Flow 60 and Flow S2, were imported and sold in the United States. (Tr. 616.) These rotary coders are manufactured by Dato Pack Europa in Spain, and exported to respondents in the United States.

THE FLOW 35 AND THE FLOW 60 INFRINGE THE PATENT

The application of the claim to the accused device to determine whether the claim has been infringed requires a finding of fact. Palumbo v. Don-Joy Co., 762 F.2d 969, 974, 226 U.S.P.Q. 5, 7 (Fed. Cir. 1985). This rule applies whether claims are asserted to be infringed literally or under the doctrine of equivalents. Texas Instruments, 231 U.S.P.Q. at 834.

Claim 1 is a means-plus-function claim. To infringe such a claim, the function must be the same, but the means can be any equivalent of the means set forth in the specification. Pennwalt Corp. v. Durand-Wayland, Inc., 833 F.2d 931, 934, 4 U.S.P.Q.2d 1737, 1739 (Fed. Cir. 1987), cert. denied, 485 U.S. 961 (1988); Laitram Corp. v. Rexnord, Inc., 19 U.S.P.Q.2d at 1370.

The parties agree that the Flow 35 and the Flow 60 models are essentially the same, and have treated them as identical for the purpose of determining infringement. (Tr. 69, 832, 1107; Respondents' Posthearing brief at 30.)

The parties also stipulated that the Flow 35, Flow 60 and Flow S2 all include certain elements of claim 1: a printing apparatus comprising a rotating printing member having at least one printing element thereon, and an inking roll for inking the printing element, said inking roll having a porous construction and being impregnated with an ink composition of the type which is solid at normal room temperatures and is rendered liquid or flowable at elevated temperatures. (Tr. 511, 1165.)

Respondents argue that the Flow 35 does not have a radiant heating means because this phrase must be interpreted as meaning a heating means that uses only radiant heating. In support of this argument, respondents rely on the doctrine of file wrapper estoppel. As discussed under claim construction, claim 1 requires radiant heating means, but the doctrine of file wrapper estoppel does not require that only radiant heating means be used. The heating means of claim 1 must include radiant heating, but the device need not heat exclusively by radiant heating.

The Flow 35 has a radiant heating means. (Tr. 418, 913.) Four heating elements are inserted in a portion of the heater block. This portion of the block is in the shape of a tube that extends into the hollow center of the print wheel without touching the print wheel. (Tr. 149, 335-336; Markem Ex. 57 at p. 39.) The heating elements elevate the temperatures throughout the aluminum heating block. (Commission investigative attorney Ex. 24; Markem Ex. 57 at p. 39.) Over time, the temperature will tend to become uniform throughout the heater block, regardless of the location of the heating elements. (Tr. 254-255, 571, 910; Markem Ex. 62 at pp. 1-2; Dato Pack Ex. 23.) Since the tubular portion of the block does not touch the printing wheel surrounding it (Tr. 327, 251, 543, 833), heat is transferred from the block to the interior surface of the printing wheel by radiation and convection, just as heat is transferred from the U-shaped portion of the block to the exterior surface of the printing wheel by radiation and convection. (Tr. 417-418, 613, 913-915.)

In the Flow 35, as in the '872 device, the inking roll may be partly heated by convection (the heated air in the narrow space between the printing elements and the surrounding heating block has room to rise to the inking

roll, unless the device is operated upside down), as well as by radiation from the heating block surrounding the inking roll. The inking roll does not have a central heating tube, as does the printing wheel, but the printing wheel is at the open end of the U, and may lose heat faster than the inking roll. The whole radiant heater block that surrounds both the inking roll and the printing wheel is kept at the same heat. The tube inside the printing wheel is part of this radiant heater block and is at the same temperature. As a result, the inking roll and the printing roll are both kept hot, although the temperatures may not be the same. (Nor are they in the '872 patent specification; see col. 9, lines 47-49.)

Respondents argue that the '872 patent teaches away from keeping the inking roll and the printing elements at different temperatures. But the inking roll and the print elements are not required to be at the same temperature. The '872 patent specification describes the heater block "at a uniform temperature in the range of 300°-350° F. during printing," but the inking roll and printing roll are at different temperatures. (Col. 9, lines 40-41, 47-49.) (See discussion at pp. 36-39, below.)

The heater block in the Flow 35 also reaches and maintains a uniform temperature over time. In distinguishing the two-piece heating block of the Flow S2 from the '872 device, respondents admit the inherent tendency of a one-piece heater block to maintain a uniform temperature. (See Posthearing Brief of Respondents at pp. 55-56.) The Flow 35 has a radiant heating means equivalent to the means set forth in the '872 specification. The Flow 35 heating means performs precisely the same function as that set forth in claim 1.

Each element of the radiant heating means of claim 1 is found in the Flow 35.

The Flow 35 has a radiant heating means that comprises a one-piece, substantially U-shaped member made of a solid block of thermally conductive material with one or more electrical heating elements therein. (Tr. 149, 404, 418-419, 604, 869, 906.)

The radiant heating means in the Flow 35 does not have exactly the same shape as the U-shaped heating block disclosed in the '872 specification. The Flow 35 heater block includes a back plate with an inner tube that heats the printing element. (The heating block of the '872 device is insulated from the back plate.) Nevertheless, the Flow 35 does have a generally inverted U-shaped member with its closed end surrounding the inking roll and its open end partially surrounding the printing member. (Tr. 149, 418-419.) The shape of the Flow 35 radiant heating device is substantially U-shaped, and is about as U-shaped as the U-shaped member depicted in the '872 patent specification.

Although the U-shaped member of the Flow 35 contains an additional element not described in the '872 specification (the central tubular member into which the heating elements are embedded), this addition does not change the fundamental similarity of the two structures. In a solid block of thermally conductive material, it does not make much difference where the heating elements are inserted.

It is found that the Flow 35 literally infringes claim 1 of the '872 patent. It is also found that the Flow 35 contains each additional restriction of the dependent claims 2-4 and 6, and that the Flow 35 literally infringes those claims. (Tr. 405-406.)

Based on the stipulation of the parties that if the Flow 35 infringes, the Flow 60 also will infringe, it is found that respondents' Flow 60 (as well as the Flow 35) literally infringes claims 1-4 and 6 of the '872 patent.

THE DOCTRINE OF EQUIVALENTS

When the doctrine of equivalents is applied to a product that does not literally infringe a patent claim, the product may be found to infringe in order "to temper unsparing logic and prevent an infringer from stealing the benefit of the invention." Graver Tank & Mfg. Co., Inc. v. Linde Air Products Co., 339 U.S. 605, 85 U.S.P.Q. 328, 330-332 (1950). Under the doctrine of equivalents a product that does not literally infringe a claim may be found to infringe if it performs substantially the same function in substantially the same way to obtain substantially the same result as the claimed product.

The doctrine cannot be used to expand the literal language of a claim to cover something that the applicant expressly gave up during the prosecution of the patent to avoid a rejection of the claim. The doctrine of file wrapper estoppel prevents one from later reclaiming subject matter given up to obtain allowance of a patent claim. Nor can the doctrine be expanded to cover an accused device that can be found in the prior art. Pennwalt, 4 U.S.P.Q.2d at 1739 n.1.

The '872 patent is not a pioneer patent, and it is not entitled to a broad range of equivalents. It is entitled to a fair range of equivalents as long as the simple improvement in the design disclosed in the '872 patent is utilized in another device. The '872 invention used one solid wrap-around heating block as a radiant heating means to heat the inking roll and the printing roll at the same time without touching them. This greatly simplified the heating process. The simplicity of this design was a significant

practical advance in the art. If an allegedly infringing design fails to use this simplified design, but instead chooses a more complex heating system, the range of equivalents will not cover the new device.

It is not necessary to reach the doctrine of equivalents to find that the Flow 35 literally infringes claim 1 of the patent. Nevertheless, respondents argued that the Flow 35 did not literally infringe claim 1 and that under the doctrine of equivalents the patentee would be barred by the doctrine of file wrapper estoppel from construing claim 1 as covering the Flow 35.

The doctrine of file wrapper estoppel would not estop the patentee from arguing that the Flow 35 is covered by claim 1. The file wrapper shows that after the examiner rejected the applicant's original claims 1-20, the applicant revised the claims and the examiner then allowed the revised claims. Claim 1 as revised is claim 1 as issued in the '872 patent.

Several of the original claims had been rejected in view of the '707 patent to West. The applicant distinguished his device from the West '707 patent device on several grounds. (Dato Pack Phys. Ex. FF at 49-51.) The applicant tried to distinguish his device from West on many grounds, when one would do. This increased the risk that the doctrine of file wrapper estoppel would narrow the claims unnecessarily.

In rejecting the original claim that referred to a unitary radiant heater, the examiner indicated that West had a unitary radiant heater. The applicant then revised claim 1 to specify that his radiant heating means must be made of a one-piece, substantially U-shaped member made of a solid block of thermally conductive material. He pointed out that he claimed:

marking unit with a one-piece wrap-around radiant heating device. By contrast, the ink supply system disclosed by West is an elaborate arrangement consisting of a fountain...and a train of rollers....Such an apparatus

would be difficult or impossible to heat using a one-piece, wrap-around radiant heating device.

The applicant noted that West had a number of separate quartz heater tubes enclosed in what appears to be a cover or housing. He pointed out that the West device lacks the "temperature stabilization" and "temperature uniformity" that can be obtained with the solid block of thermally conductive material claimed by the applicant. The West tubes lose about 80 percent of their heat output within two seconds after the current is shut off, and West's temperatures can fluctuate drastically unless the power level to the tubes is carefully controlled. (Dato Pack Phys. Ex. FF at 50-51.) West had a problem with "hot spots" on the surface of the plate roller, resulting from the localized heat produced by West's separate quartz tubes.

In contrast, the '872 device had a solid block of thermally conductive material that provided a significant thermal mass that tended to stabilize the temperature of the radiant heating device over time, and reduced localized hot spots. The applicant concluded (Dato Pack Phys. Ex. FF at 51) that:

[t]hese advantages are important in the present invention because optimum printing is obtained with thermoplastic hot-melt ink compositions when consistent and uniform temperatures are maintained in the printing apparatus.

The applicant also revised claim 1 to define more precisely the "surrounding" relationship of the radiant heater with the inking roll and printing member. Having the radiant heater surround the inking roll and the printing member was described as an important feature from the standpoint of maintaining uniform temperatures on these rolls. (*Id.* at 50.) In contrast, West's heater did not surround an inking roll and a printing member. Revised claim 1, however, did not require that the temperatures of the inking roll and

the printing elements be the same or that they be held at a constant temperature.

It is not clear what the applicant meant when he used the phrase "consistent and uniform temperatures are maintained in the printing apparatus." What must have a uniform temperature? What does "in the printing apparatus" mean? Does this mean that all temperatures in the entire device must be the same or that only the heater block must have a uniform temperature?

The applicant seemed to focus most of his arguments on the contrast between West's use of quartz tubes in which temperatures fluctuate rapidly and create hot spots, and the applicant's solid heater block of thermally conductive material that maintains consistent and uniform temperatures during operation. It is unlikely that he was referring to the printing roll and the inking roll as maintaining uniform temperatures because the specification said the opposite at column 9, and none of the claims required the two rolls to be at the same temperatures. The general description of the invention in the file wrapper emphasizes the temperature stability of the heater block. The applicant points out that the heater block conforms to the shape of the two rolls, and this helps the application of uniform heat to each roll, rather than heating the two rolls by a number of localized "hot spots", as in West.

The troublesome reference is where the applicant suggested that having the radiant heater surround the inking roll and the printing member was an important feature from the standpoint of maintaining uniform temperatures on these rolls. (*Id.* at 50.) Does the word "on" suggest the application of uniform temperatures to the surface of the rolls, or does the phrase imply that the rolls will be maintained at the same temperatures? Although revised

claim 1 required that the radiant heating means at least partially surround the inking roll and the printing member, it did not require that the temperatures of the inking roll and the printing elements be the same or that they be held at a constant temperature, and the specification makes it clear that the inking roll and the printing roll are not at the same temperature.

The reference to maintaining uniform temperatures on the rolls is construed as meaning that the applicant's device applies uniform heat to the surface of the two rolls from the single heater block of thermally conductive material which maintains a uniform heat. This is consistent with the language bridging col. 4 and 5 of the patent specification, indicating that in order to provide for efficient and "uniform heating at the surfaces of the inking roll and printing roll," the heater block is preferably provided with cylindrically curved interior surfaces which conform closely to the peripheral surfaces of these rolls. These lines refer to applying uniform heat at the surfaces of the two rolls. They do not describe the two rolls as being at the same temperature.

The device disclosed in the '872 patent would not have kept the two rolls at the same temperature. The printing roll is only partially surrounded by the heater block because its printing surface must be exposed. It loses heat to the air. The material to be printed (the web) is cool and will draw heat from the printing roll. If uniform heat is applied to both rolls from the heater block, the partially exposed printing roll will lose heat faster than the inking roll. A fair reading of the file wrapper, together with an examination of the specification and the patent drawings, shows that the temperatures of the two rolls could not be the same if they were heated primarily by a heater block that was at a constant heat, but one of the rolls

was only partially surrounded by this heat source. The only additional sources of heat for the printing roll would be minor reradiation from the core holding the printing roll and possibly some heat from warm air carried to the printing roll by convection. Moreover, the specification clearly states that the temperatures of the two rolls are not the same. (Markem Ex. 2, col. 9, lines 47-49.)

The applicant did not say in the file wrapper that the temperatures of the two rolls should be identical, and the vague language at p. 50 will not be construed as requiring this. To find otherwise would be inconsistent with the language in column 9 in the specification, which states unequivocally that the two rolls are at different temperatures.

It is found that if the Flow 35 did not literally infringe claim 1, the patentee would not be barred by the doctrine of file wrapper estoppel from arguing that a device in which the inking roll and the printing element are not held at the same constant temperature infringes claim 1.

Nor would the reverse doctrine of equivalents support a finding that respondents' device is totally different from the invention of the '872 patent even though respondents' device literally includes each element of claim 1 and is the equivalent of the device disclosed in the patent specification. The radiant heating means in respondents' device is very similar to the device disclosed in the patent specification and serves precisely the same function.

If the Flow 35 did not literally infringe claim 1, it would be found that both the Flow 35 and the device of claim 1 of the '872 patent perform the same function in substantially the same way with substantially the same result, and that the Flow 35 and the Flow 60 infringe the claims of the patent in issue under the doctrine of equivalents.

THE FLOW S2 DOES NOT INFRINGE THE PATENT

Respondents' Flow S2 does not literally infringe claim 1 of the patent or any of the dependent claims because the S2 does not contain a:

radiant heating means comprising a one-piece, substantially U-shaped member made of a solid block of thermally conductive material with one or more electrical heating elements therein

The heating block of the Flow S2 includes a radiant heating means, it is substantially U-shaped, and one or more electrical heating elements are imbedded in the heating block.

The other requirements of the radiant heating means as set forth in claim 1 are not found in the Flow S2 nor are they the equivalent of what is set forth in the '872 patent specification.

The whole heating block of the Flow S2 is made of two separate heating sections made of an aluminum alloy. The two heating sections are separated by a plastic called Primef, which is an insulator. The casing enclosing the upper section and the lower section of the heating block also is made from Primef. Each section of the heating block has its own heating element that can be controlled independently. In order for the coder to operate, the heating elements in both sections must be on. (In contrast, the heating elements in the device disclosed in the '872 specification can be in any part of the heating block, and they will heat the whole block.) (Tr. 437-438, 862-864; Markem Ex. 2, at 4, 17-19; Dato Pack Exs. 85, 89.)

The whole heating block is not in "one piece" as that term in claim 1 has been construed herein. In the device disclosed in the '872 specification, a one-piece heating block that was thermally conductive could have one or more heating elements anywhere in the heating block, and the heat would spread quickly throughout the heating block. Mr. Perra testified that "...if you've

got separate pieces, you've got to have separate heat sources....So if you talk about one-piece, I'm talking about the one piece that has the heat source." (Tr. 278.) In the S2, the upper and lower heating units are in one piece only in the sense that the two heating sections are physically joined together with only Primef separating the sections.

The whole heating block of the S2 is not "thermally conductive" as that term in claim 1 has been construed herein. Because the entire heating block is not thermally conductive, it falls outside of the definition of a one-piece solid block of thermally conductive material.

Primef is an insulator, which is the opposite of a thermally conductive material. (Tr. 857-858, 1011-1014.) Primef will conduct a certain amount of heat over a period of time, but aluminum would conduct 550 times more heat, based on the relative conductivities of the two materials. (Tr. 1014.)

Any material, even an insulator, that is connected to a material on one side that has one temperature and to a material on the other side that is at another temperature will, over a period of time, reach a temperature that is equal to the average between the temperature of the material on one side and the temperature of the material on the other side. (Tr. 1017.) In the Flow S2 device, the Primef reaches the average temperature between the two heating sections by the time that the Flow S2 gets hot enough so that it will print. If the temperature of the upper section surrounding the inking roll is maintained by one heater at about 120 degrees centigrade, and the temperature in the lower section is maintained by a separate heating element at about 150 degrees centigrade, after enough time has passed for the device to reach operating temperature, the Primef will reach a temperature of about 135 degrees, the average between the heat in the upper and lower sections. The

Primef will stay at that temperature as long as the upper section is independently maintained at 120 degrees and the lower section is maintained at 150 degrees. (Tr. 1048-1053.)

While the Flow S2 is at its operating temperature, every part of the S2, including the Primef, will be losing heat to any area next to it that is at a lower temperature. At the same time it will be gaining heat from any area next to it that is at a higher temperature. Nevertheless, the Primef will be held at the average of the temperatures in the two heating sections that it separates because the heating elements in each of these sections continuously replace heat that they are losing to cooler areas, and maintain their separate temperatures. (Tr. 939-942, 1011-1018, 1028-1034.) At the same time the upper and lower heating sections and the Primef are heating the inking roll and the printing member by radiation. (Tr. 505-506, 941.)

The Flow S2 differs from the device disclosed in the '872 patent in that the S2 when it is at its operating temperature does not have a single heating block at a single sustained temperature. Unlike the device of the '872 patent, the S2 maintains different temperatures in the upper heating and lower heating sections. No matter how long the respondents' device is in operation, one section will be hotter than the other.

The Flow S2 maintains temperatures high enough to melt the ink and keep the printing element hot until it prints, once the device is at operating temperature. The temperature of the Primef will not vary significantly nor will it change the sustained temperatures in the sections of the heating block adjoining it. The temperatures of the upper section and the lower section may be maintained at 120 and 150 degrees or higher, depending on desired operating conditions, but the Primef will always be at a temperature that is the average

of the temperatures of the upper and lower sections. (Tr. 938-940, 1050-1053.) This is not like the simple device of the '872 patent, where the temperature of the one-piece solid block of thermally conductive material quickly brings the entire block to one temperature level. I agree with the Commission investigative attorney that the S2 is more like the prior art, in which there were separate heating sections heating the inking roll and the rotary printing element, than like the device disclosed in the '872 patent.

In the S2 device the respondents successfully designed around claim 1 of the '872 patent. The S2 device is more complex than the device of the '872 patent. It does not use the simple one-piece radiant heater surrounding and heating both the inking roll and the printing element that was the improvement of claim 1 over the prior art. The radiant heating means of the S2 is not the equivalent of the radiant heating means disclosed in the '872 patent specification.

It is found that the Flow S2 does not literally infringe claim 1 or any of the claims dependent from claim 1.

THE DOCTRINE OF EQUIVALENTS

In a means-plus-function claim, the doctrine of equivalents does not expand the scope of literal infringement with respect to the means. Literal infringement of such a claim can be found only if the means in the accused product is structurally equivalent to the means described in the specification. Johnston v. IVAC Corp., 885 F.2d 1574, 1580, 12 U.S.P.Q.2d 1382, 1386-87 (Fed. Cir. 1989). Unless the doctrine is limited by file wrapper estoppel, the doctrine of equivalents can expand the scope of the claim relating to the function only. The function under the doctrine of equivalents can be an equivalent function, while to find literal infringement

the function must be the same as the function set forth in the patent specification. In all the respondents' and complainant's devices in issue, the function of the radiant heating means is the same: to elevate the temperatures of the inking roll and printing roll so that the device can print. The S2 radiant heating system has an additional function of prolonging the life of the inking roll.

In addition to finding equivalent means in the specification and the same or an equivalent function as in the claim, to find infringement under the doctrine of equivalents each element of the claim or the substantial equivalent of that element must be found in the accused product. Becton Dickinson and Co. v. C.R. Bard, Inc., 922 F.2d 792, 798, 17 U.S.P.Q.2d 1097, 1101 (Fed. Cir. 1990). The function of the radiant heating means as set forth in claim 1 is to maintain the inking roll and the printing element on the printing member at elevated temperatures. The term "elevated temperatures" has been construed as meaning that the inking roll and the printing element have to be hot enough so that the ink will flow and not solidify before the printing element prints on the tape or package under it. In both the S2 and the device disclosed in the '872 patent specification, the inking roll and the printing element are maintained at elevated temperatures.

But the Flow S2 does not have equivalent means to each element of the means set forth in claim 1 or in the '872 patent specification. The part of claim 1 for which no equivalent means is found in the S2 is in the phrase "one-piece, substantially U-shaped member made of a solid block of thermally conductive material." In the Flow S2, there are two pieces of thermally conductive material (the two aluminum heating blocks). The Flow S2 has a one-piece heating means only in the sense that it is molded together and will

not fall apart. This one piece could be described as a solid block almost in the same sense that the device claimed in the '872 patent is described as a solid block to distinguish it from the prior art devices that were heated by separate parts, but in claim 1 of the patent the one-piece solid block must be of thermally conductive material. No equivalent means to a one-piece solid block of thermally conductive metal is found in the Flow S2. Nor does the Flow S2 have a radiant heating means equivalent to that set forth in the '872 patent specification.

Because there is no equivalent for this means element, the Flow S2 does not infringe under the doctrine of equivalents.

It is not necessary to reach the question of file wrapper estoppel, but that would have prevented a finding of infringement under the doctrine of equivalents because of the applicant's argument in the file wrapper that his '872 device should be distinguished from the prior art because his one-piece heater block could maintain uniform heat.

The significant difference between the Flow S2 and the '872 device is that the '872 device simplified the heating means of the prior art, while the S2 uses a far more complex heating system than the one disclosed in the '872 patent.

It is found that the Flow S2 does not infringe the '872 patent either literally or under the doctrine of equivalents.

DOMESTIC INDUSTRY

All of the Markem models in issue are made in New Hampshire. (Tr. 635-636.) Respondents stipulated that if Markem practices the patent, there would be a domestic industry with respect to the rotary coders sold by Markem. (Tr. 1184.)

It was only necessary for complainant to prove that one of its models practiced each of the claims in issue of the '872 patent. Complainant's witnesses testified that Markem's rotary coder models 984, 986A, 974, 977, 987 practiced each of the claims in issue of the '872 patent. (Tr. 133-141, 529-535.)

Respondents argue that the complainant does not practice claim 1 of the patent because they construe claim 1 as requiring that a coder covered by claim 1 use radiant heating means only. None of Markem's models heats by radiation alone.

Claim 1 has been construed as covering heating devices that transfer heat by radiation as well as by convection or conduction. There is no dispute about the fact that the Markem models use radiation. As long as Markem's models heat by radiation, and meet all of the other requirements of claim 1, the use of other heating means as well as radiation does not preclude a finding that a Markem model practices claim 1 of the patent. These models practice claim 1 and dependent claims 2-4 and 6 of the patent. It is found that there is a domestic industry practicing the patent.

CONCLUSIONS

It is found that respondents Dato Pack Europa, S.A., Franklin Manufacturing Corp., Professional Sales Associates, Inc., Dato Coding Systems, Inc., and Imaje, S.A., have directly or indirectly infringed valid claims of the '872 patent. There is an industry in the United States as required by subsection (a)(2) of Section 337.

It is found that there is an unfair act under Section 337 of the Tariff Act as amended in the importation into the United States, and the sale within

the United States after importation, of certain rotary printing apparatus by reason of infringement of claims 1, 2, 3, 4 and 6 of the '872 patent.¹

The evidentiary record in this proceeding consists of all exhibits identified in Commission investigative attorney Exhibit 1, Markem Exhibit 1, and Dato Pack Exhibit 1. The evidentiary record also includes the transcript of the testimony at the hearing. The evidentiary record is hereby certified to the Commission. 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: August 28, 1991

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).

