United States District Court,
W.D. Kentucky, at Louisiville.

BROWN & WILLIAMSON TOBACCO CORPORATION,
Plaintiff.
v.
PHILIP MORRIS INCORPORATED,
Defendant.

Civil Action No. 3:89CV-0470-S

April 1, 1999.

Andrea L. Wayda, Douglas R. Nemec, James W. Gould, Jeffrey J. Oelke, John A. Diaz, John W. Osborne, Maria C.H. Lin, Michael A. Nicodema, Stephen R. Smith, Steven F. Meyer, Morgan & Finnegan, New York, NY, Charles Gibson Middleton, III, Middleton & Reutlinger, William C. Boone, Jr., William C. Boone, Law Offices, Louisville, KY, for Plaintiff.

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FINDINGS OF FACT AND CONCLUSIONS OF LAW

CHARLES R. SIMPSON III**, Chief District Judge.**

This is an action for patent infringement brought by Brown & Williamson Tobacco Corporation (hereinafter "B & W") seeking to enforce its rights under U.S. Patent Reissue No. 32,615 (hereinafter the "'615 patent," the "reissue patent," or the "Luke patent"). B & W, a subsidiary of British American Tobacco Company, Ltd. (hereinafter "BAT"), is a Delaware corporation having its principal place of business in Louisville, Kentucky.

This action was brought against Philip Morris, Incorporated (hereinafter "PM"), alleging that PM's Virginia Slims Superslims cigarette (hereinafter "VSSS") infringes the '615 patent. PM is a Virginia corporation, with a principal place of business in Louisville, Kentucky for the manufacturing of cigarettes through its Philip Morris USA division.

The action was tried to the court during the period December 3, 1996 through April 9, 1997. This first phase of the bifurcated trial addressed the issues of validity, enforceability, infringement, and willfulness.

FINDINGS OF FACT

A. HISTORY OF THE '615 PATENT

John A. Luke, an employee of BAT in Southhampton, England, worked in the field of research and design of cigarettes. In the early 1980s, Luke was focused in his research on ways to utilize less tobacco in a cigarette in order to reduce the company's manufacturing costs and thereby increase profits.

Luke believed that a conventional king-size cigarette (containing approximately 880 mg of tobacco) burned very inefficiently. He sought a structure which would permit a more efficient utilization of tobacco in a cigarette.

There are many factors to be considered and balanced in designing a cigarette. What was critical to Luke's research was determining how much tobacco was consumed per puff, and finding a way in which to reduce the amount each puff consumed. Scientists can measure the tobacco consumed during the burning of a cigarette in a number of ways.

The mass static burn rate of a cigarette is a measure of the amount of tobacco consumed per minute while the cigarette is smouldering (that is, when it is lit but not being puffed).

The linear burn rate of a cigarette is a measure of the amount of time it takes to burn a specified segment of the cigarette rod. The number of puffs that can be obtained from a given cigarette is dependent upon the burn rate of that cigarette. Cigarette scientists have studied and quantified the relationships between burn rate and many other cigarette parameters.

Persons of ordinary skill in the art of cigarette design in the 1980s were familiar with various methods of manipulating design parameters for finished cigarettes to control characteristics of the finished product such as puff count, tar delivery, taste, sidestream smoke, and product appearance, to name just a few.

Luke made the discovery he later claimed in his patent applications while varying some of these design parameters while attempting to increase the efficiency of the tobacco utilization in cigarettes.

Luke initially pursued an annular cigarette construction, preparing 13.5 mm circumference core tobacco rods to be placed within an annulus of a second type of tobacco. Luke initially manufactured these small circumference tobacco rods as a component of an overall cigarette of conventional circumference. Luke determined, however, that the small tobacco rods themselves could be smoked. He then pursued the concept of reducing the circumference of a conventional cigarette, developing prototypes in circumferences within the range of 10 to 19 mm.

In the fall of 1983, Lance Reynolds ("Reynolds"), the Director of Product Development at B & W, became aware of John Luke's prototypes for a reduced circumference cigarette at BAT's laboratories in Southampton, England. In early 1984, at Reynolds' request, Luke sent prototype tobacco rods to B & W product development personnel in Louisville, Kentucky. On March 22 and 23, 1984, Luke came to Louisville and met with various members of B & W's research and development group. Luke brought additional prototype tobacco rods with him. The early prototype reduced circumference filtered cigarettes were manually assembled from separately manufactured tobacco rods and filters.

During Luke's visit to the B & W facility in March of 1984, B & W requested an exclusive license for Luke's reduced circumference cigarette concept in the United States. In return, B & W offered to develop a

commercial product from Luke's prototypes. BAT agreed to grant a license for Luke's concept to B & W within a few months after Luke's visit.

Research and development for the reduced circumference cigarette was conducted by B & W during 1984 under the name "Project VISA." B & W personnel working on Project VISA were told to keep their work on the project confidential. B & W believed that confidentiality was necessary to avoid preemption by competitors. Documents generated by B & W which related to Project VISA were designated "confidential" or "limited" and were distributed on a need-to-know basis.

In 1984, Kapular & Associates, Inc. ("Kapular"), a market research firm located in Arlington Heights, Illinois, was hired to conduct a smoker research study to test prototype reduced circumference cigarettes with ordinary smokers to determine if cigarettes having a circumference below 19 mm would be acceptable by ordinary smokers as a practical, smokable cigarette. B & W had determined that empirical data generated solely by laboratory equipment could not gauge how an actual smoker would manage a circumference of less than 19 mm. B & W considered it necessary to research whether ordinary smokers would find such a cigarette practical and acceptable. Such determinations are necessarily subjective smokers' assessments.

The smoker research study was conducted by Kapular in New York and Chicago May 31 through June 5, 1984. There were 65 to 70 participants in the study divided into eight groups, two female and two male groups in each city. Each potential participant was subjected to a screening procedure. Individuals who worked for a market research firm, an advertising agency, or a company that makes or sells cigarettes were excluded from participating in the study. A second screening was done at the research facility. Each smoker who was retained to participate was paid $25 (Chicago participants) or $30 (New York participants) for participating.

The Kapular and B & W personnel who were involved with the smoker research study took reasonable precautions to safeguard the confidentiality of Project VISA. It was made clear to the smokers retained for the study that the subject matter of the study should be kept confidential. The study was conducted at controlled research facilities. The facilities of the research firms Field Work-Chicago and Wolf Altschul & Callahan, Inc.-New York were made available to Kapular for the studies.

It was the practice of Kapular, when conducting qualitative research for B & W, to secure documents and other materials such as samples in a locked area of the facility. Work with project materials or discussions about the projects was routinely done privately. Project materials were secured overnight and when otherwise unattended.

B & W research personnel prepared by hand 200 to 250 of the prototype filtered cigarettes to be used in the study. During the study, all prototype cigarettes were counted to ensure that no participant removed any prototypes from the site. The researchers collected unsmoked prototypes, cigarette butts, and ash from the smoked prototypes.

The study of each group was conducted in two parts. One-on-one interviews of each participant were conducted. These interviews were held in private interview rooms. After the interviews, the participants were brought together for a focus group discussion about the prototypes. These group discussions were conducted in a room which contained a one-way mirror. Kapular and B & W personnel observed the participants as they handled, smoked, and discussed the prototypes.

Kapular then compiled and analyzed the data obtained from the smoker research study. It submitted a report to B & W which discussed, among other things, the physical attributes of taste, strength, tar level, draw, and handling of the prototypes. Additionally, the report focused on cigarette length, tipping color, price, image, packaging, and name.

On July 22, 1985, John A. Luke filed an application for patent which resulted in the issuance of United States Patent No. 4,637,410 (the "'410 patent" or "original patent" herein) on January 20, 1987. Shortly after the issuance of the '410 patent, Luke filed a reissue application which resulted in the issuance of United States Patent No. Re. 32,615 (the "'615 patent" or "reissue patent" herein) entitled "Cigarettes" on March 1, 1988.

B & W is the owner of all right, title, and interest in the '615 patent.

Claims 1, 4, and 11 of the '615 patent are in issue in this litigation.

B. THE '615 PATENT

The '615 patent describes a finished, filter-tipped cigarette of uniform cross-section throughout its length, in which the tobacco is circumscribed by a cigarette paper wrapper the outer circumference of which is within a range of 10 to 19 mm, the tobacco packing density is within a range of 150 to 350 mg/cm ^{3} and the free mass burn rate is within a range of 25 to 45 mg min $^{-1}$. Luke claims in the '615 patent that a commercially acceptable cigarette can be made combining these properties resulting in a cigarette which utilizes tobacco at greater efficiency than conventional, commercially-marketed cigarettes. Luke claimed in his '615 patent that a cigarette according to his invention was capable of sustained smoulder when lit but not being smoked.

The '615 patent contains sixteen claims. Claim 1 is an independent claim. Claims 2 through 16 are claims which depend from Claim 1.

B & W asserts that the manufacture, use, and sale of VSSS infringes Claims 4 and 11 of the '615 patent, either literally or under the doctrine of equivalents.

Claims 4 and 11 depend from Claim 1, which recites a "cigarette paper wrapper" as an element of the claim. The "cigarette paper wrapper" is referred to in the specification, discussed in the file wrapper, and illustrated in the '615 patent.

Claim 1 states:

A finished cigarette of commercially acceptable quality and elegant appearance in the form of an elongated rod of uniform cross-section throughout its length capable of sustained smoulder when lit but not being smoked, said elongated rod consisting of a cut tobacco filler, a cigarette paper wrapper, circumscribing said cut tobacco filler, a filter in abutment with one end of said cut tobacco filler and a tipping wrapper maintaining said filter in abutment with said one end of said cut tobacco filler, the circumference of said elongated rod being within a range of 10 mm to 19 mm, and having a cut tobacco filler packing density within the range of 150 mg per cm ^{3} to 350 mg per cm ^{3} yielding a free burn rate of said rod within a range of 25 to 45 mg min $^{-1}$, the aforesaid cigarette utilizing tobacco at a greater efficiency than conventional commercially marketed cigarettes.

Claim 4 states:

A cigarette as claimed in claim 1, wherein the packing density of said cut tobacco filler is within a range of 200 mg per cm ^{3} to 300 mg per cm ^{3}.

Claim 7 states:

A cigarette as claimed in claim 1, wherein said cigarette paper wrapper contains a conventional cigarette paper air permeability value and a conventional level of burn rate promoting additives.

Claim 11 states:

A cigarette as claimed in claim 1, which provides in excess of about 8 puffs.

Luke stated in his '615 patent that prior to his invention it had been thought that about 60 mg of tobacco had to be consumed per minute in order to assure maintenance in the coal of enough heat to sustain the coal in a smouldering condition. He contended that his cigarette met the goal of utilizing significantly less tobacco than that used in orthodox commercial cigarettes without the necessity of making compensatory adjustments in order to achieve the designated burn rate and smoulder capability. Luke coined the phrase "tobacco utilization efficiency" or "TUE" to describe the measure of the weight of tobacco consumed per puff in a cigarette. The patent claims do not recite the weight of the tobacco to be used in making a cigarette according to the invention. Certain structural parameters are specified, including circumference of the tobacco rod, packing density, mass static burn rate, and number of puffs yielded per cigarette.

The specification states:

It is a requisite of cigarettes of commercially acceptable quality that when lit but not being smoked, the coal continues to burn, at a slow rate, a condition usually referred to as smouldering. A number of cigarette design parameters affect the smoulder rate, otherwise known as the free or static burn rate. One of these is the air permeability of the cigarette paper; the lower the air permeability, the lower is the smoulder rate. Another factor relating to smoulder rate is the amount of tobacco which is consumed in unit time ... The present invention is based on our finding that in point of fact cigarettes having circumferences of 19 mm or less and free burn rates of 45 mg min $^{-1}$ or less smoulder in a fully acceptable manner and that in addition such cigarettes exhibit a number of significant practical advantages. There is no necessity in order to provide cigarettes according to the present invention which smoulder reliably between puffs to make compensatory adjustments to the cigarette paper air permeability value or to provide the cigarette paper with unorthodox levels of burn rate promoting additives, or in fact to make compensatory adjustments in regard to any other parameters which affect smoulder rate ... Thus a cigarette may be provided according to the present invention which, compared with a cigarette of orthodox dimensions, having, for example, a circumference of 25 mm, comprises considerably less tobacco, 25% less for example, and yet which provides an equal, or even greater number of puffs. The actual number of puffs, will, of course, be dependent inter alia upon the length of the cigarette.

The '615 patent is a reissue of the '410 (the original) patent. Luke filed his reissue application addressing an error made in the original application in the analysis of the prior art Lephardt patent. He also brought a number of additional references to the examiner's attention in the reissue application.

Luke changed the claims of the '410 patent, rewriting Claim 1 almost entirely. He also added eleven new claims.

The '410 patent recited a "paper wrapper" as an element of the patent. The '615 reissue patent recites a "cigarette paper wrapper," thus amending the "paper wrapper" element of the original patent. The amendment was made in order to exclude the "corrugated paper wrapper" of the prior art Lephardt patent.

Lephardt described a "conventional cigarette wrapper" as "ha[ving] little structural strength and serv[ing] mainly to contain the rod of tobacco, ... the cigarette rod ow[ing] its structural strength almost entirely to the density of the tobacco in the rod." United States Patent No. 4,553,556, col. 1, lines 24-31, 37-39, 47-50.

Luke distinguished his "cigarette paper wrapper" from the corrugated paper wrapper recited by Lephardt:

(6) By contrast, Lephardt discloses a cigarette which includes as an element, a thick *corrugated paper wrapper* which is excluded by my amended claims. The provision of a corrugated paper wrapper is the main feature of the Lephardt patent, and is for the purpose of providing a cigarette with structural rigidity "relatively independent of the density of the tobacco" (col. 1, lines 38-39). Thus, Lephardt's disclosure is a clear teaching away from my invention....

(11) As I previously noted at Paragraph 6 above, the Lephardt patent disclosure is directed to a cigarette whose structural rigidity is *not* dependent upon the density of the tobacco packed into the cigarette:

"... [T]he conventional cigarette wrapper has little structural strength and serves mainly to contain the rod of tobacco. Thus, the cigarette rod owes its structural strength almost entirely to the density of the tobacco in the rod. A conventional cigarette has a rod of compacted tobacco shreds surrounded by a very thin paper wrapper. Its rigidity and firmness are largely dependent on density of the rod ... Accordingly, there exists in the art a need for a cigarette in which the structural rigidity of the cigarette is relatively independent of the density of the tobacco ... The corrugated wrapper, when incorporated in a cigarette, provides a cigarette in which firmness and rigidity can be made independent of the density of the smoking material. ["] (Patent 4,553,556, col. 1, lines 24-31, 37-39, and 47-50).

'615 Reissue Application (DX 10) at pp. 13; 25-26.

Luke brought the Ten Cent cigarette to the attention of the patent examiner in his reissue application. In his application, he urged that the cigarette was not prior art because (1) it was not known or used in the United States, and that (2) it was an unfiltered, low-quality cigarette "sold primarily to the very young or elderly African male in the lower social class" in Kenya and Tanzania. DX 10.

Luke also utilized 1969 laboratory reports to analyze specifications of sample Ten Cent production cigarettes. (He stated in the application that he had been unable to obtain an actual sample of a pre-1974 Kenya Ten Cent cigarette.)

From the data in these laboratory reports, which included measures of density, weight, length, circumference, and average puffs, Luke calculated the TUE for these cigarettes:

The 5.2 average number of puffs per cigarette and the average tobacco filling density of 285 mg per cm ^{3}

shown by the annexed Exhibit 7 [the 1969 laboratory reports] calculates to approximately 88 mg of tobacco utilized per puff, which is similar to that of the conventional cigarette referred to in Table 3 of my 4,637,410 patent. Thus, tobacco utilization in the pre-1974 "Ten Cent" brand cigarette does not resemble the efficiency of tobacco utilization obtained with the structure of my claimed invention ... The fact that tobacco utilization in the pre-1974 "Ten Cent" brand cigarette was approximately one-half that obtained with my claimed cigarette indicates that the burn rate was outside my claimed free burn rate of 25 to 45 mg tobacco per minute, thus leading away from my invention.

DX 10, pp 31-32. In a notice by Patent Examiner Millin on August 19, 1987, it was stated:

The claims of this re-issue application are considered to be patentable over the prior art cited in this office action. Specifically, the prior art cited in the original instrument (U.S. Patent to Lephardt) and the documents cited by the applicant (Exhibits 1-8) have been reviewed. As to applicant's Exhibits 4-7, there is no basis or motivation to modify the cigarette described in these Exhibits to have a burn rate within the rage of 25 to 45 mg/min.

DX 10, p. 162.

In his determination of the TUE for the Ten Cent cigarette, Luke relied upon the puff count numbers given in the laboratory reports. The TUE calculations reflect the fact that the Ten Cent cigarette is an unfiltered cigarette, as puff count for unfiltered cigarettes is calculated under a different protocol than used for filtered cigarettes.

In his deposition, Luke stated that filtered and unfiltered cigarettes differ:

Q: Did you take a non-filtered tobacco rod and add a filter to it, a 20 millimeter filter, you do not know what effect that would have on tobacco utilization efficiency?

[Luke] A: I do not. Nobody knows that effect because you change the whole structure of the product.

Q: You never gave any thought to what happens to the utilization efficiency of a non-filtered cigarette if you add a filter to it?

A: A plain cigarette which is a definition of a non-filtered cigarette is a different animal to a filtered cigarette. They are the results of starting a product solution and going in different directions.

Q: So they are drastically different?

A: Chalk and cheese.

Q: Night and day we would say in the States. So you never gave any thought to what would happen to the tobacco utilization efficiency of a non-filtered cigarette if you added a filter?

A: Again, I cannot add to what I said, that it is not an obvious or natural comparison to make.

Luke depo., pp. 242-43.

Different tests or protocols have been established as standard for determining puff count of filtered and unfiltered cigarettes. The standard protocol for an unfiltered cigarette is to measure the number of puffs obtained from an unfiltered tobacco rod from the time it is lit until the rod is burned down to a 23 mm butt. Filtered cigarette puff counts are measured determining the number of puffs obtained from the time the rod is lit until it is burned to a point 3 mm from the tipping paper. Thus, when an unfiltered cigarette is tested, 37% of the total tobacco in the cigarette is unsmoked; in a filtered cigarette, 10% is unsmoked. These standardized puff count tests are performed utilizing a smoking machine which takes calibrated puffs from the cigarettes over a period of time.

The '615 patent particularly claims a finished cigarette while the '410 patent did not. The '615 finished cigarette is limited to those (1) of commercially acceptable quality, (2) of elegant appearance, (3) possessing a filter, and (4) utilizing tobacco at greater efficiency than conventional, commercially marketed cigarettes, among other specific limitations. These limitations and others were added to the new Claim 1.

"Commercially acceptable quality" was not defined in the claims of the patent or in the prosecution history. The extrinsic evidence offered at trial regarding "commercially acceptable quality" consisted of testimony from persons experienced in the cigarette manufacturing industry. Those experts who were able to define the phrase stated that it included cigarettes which were technically feasible, capable of manufacture, had acceptable resistence to draw, had an acceptable puff count, smouldered reliably, were palatable, and provided a degree of satisfaction to the smoker.

"Elegant appearance" was not defined in the claims of the patent or in the prosecution history. "Elegant appearance" in a cigarette was quantified to some extent by a number of experts in the case, for purposes of attempting to identify structures which possesses this attribute. They suggested that cigarettes whose ratio of circumference to length was less than that of other cigarettes are more elegant in appearance. The experience or impression of "elegant appearance" appears to derive from a slimmer, seemingly more elongated rod. For example, the Capri cigarette which is 17 mm in circumference and 120 mm long (ratio = 17/120 = .14) has a more elegant appearance than the Marlboro which is 25 mm in circumference and 80 mm in length (ration = 25/80 = .31). "Elegant appearance," being a subjective experience, may be achieved differently or viewed in other ways. However, this derivation from the orthodox 25 mm cigarette was identified by a number of experts in this case as Luke's means of achieving it.

In this action, B & W contends that PM's VSSS infringes Claims 4 and 11 of the '615 patent which (1) limits the packing density of the Luke cigarette as set forth in Claim 1 to 200 to 300 mg/cm ^{3} (Claim 4) and (2) limits the Luke cigarette as set forth in Claim 1 to those which produce in excess of eight puffs (Claim 11). B & W thus argues that each and every element of Claims 1, 4, and 11 of the '615 patent or their substantial equivalent are present in the VSSS cigarette.

C. PM'S VSSS CIGARETTE

B & W's infringement claim challenges PM's manufacture, use, and sale of the VSSS cigarette. VSSS is a filter-tipped cigarette with a circumference of 17 mm, containing 430-465 mg of tobacco, having a packing density in the range of 270 to 290 mg/cm ^{3}, and a free mass burn rate in the range of 39 to 42 mg min $^{-1}$, and delivering 7.6 to 8.8 puffs. VSSS has a cigarette paper wrapper which is wrapped around a cut tobacco filler to form a tobacco rod.

Between 1983 and 1988 scientists at PM worked to develop a cigarette which reduced visible sidestream

smoke. In 1988 PM set a goal to develop a cigarette which would achieve a 70% reduction in visible sidestream smoke over standard 25 mm cigarettes.

PM experimented with various chemically treated papers manufactured by Kimberly-Clark and Ecusta, two prominent paper manufacturers in the industry, which reduced the visible sidestream smoke to some degree, but posed other problems such as unacceptable aftertaste and poor ash formation.

Kimberly-Clark developed a paper which utilized a filler of small calcium carbonate crystals. Ultimately, PM designed the VSSS utilizing a two-ply wrapper from Kimberly-Clark and reducing the circumference of the cigarette with this paper from the standard 25 mm to 17 mm.

The two-ply wrapper consisted of two layers of paper. The inner layer had a basis weight of 18 g/M. The outer layer contained a combination of the burn retardants potassium succinate, monoammonium phosphate, and carboxymethyl cellulose. It also contained calcium carbonate crystals which had a surface area of 20-80 square meters per gram. The outer layer had a basis weight of 50g/M.

On June 5, 1989, PM applied for a patent on the two-ply wrapper. On March 12, 1991, U.S. Patent No. 4,998,543 was granted on the wrapper. The VSSS was initially produced with this two-ply wrapper.

At the time that PM was developing VSSS, there was no industry standard for measuring visible sidestream smoke, although there did exist the Sidestream TPM (Total Particulate Matter) method which had been used by PM previously.

PM developed an "eight port visibility instrument" to measure visible sidestream smoke using an optical system calibrated to a wavelength that mimicked the human eye. PM had an independent testing firm, United States Testing Company, evaluate their device. The firm determined that it appeared to produce results which were reliable and reproducible. From its own tests, PM concluded that the VSSS achieved its reduced visible sidestream objective.

PM sold VSSS for two years with the two-ply wrapper. Beginning in 1991 and continuing to the present, PM has used a single-ply "extra-heavy" wrapper in the VSSS. This wrapper contained the same small calcium carbonate crystal filler as the two-ply wrapper, and had a basis weight of 53 g/M. It also contained the burn retardant monopotassium phosphate.

On March 2, 1992, PM applied for a patent on its single-ply wrapper. On September 19, 1995, U.S. Patent No. 5,450,862 was granted on the "extra-heavy" wrapper. PM began utilizing its "extra-heavy" wrapper after determining that its two-ply wrapper was too costly and too difficult to manufacture.

Both the two-ply and extra-heavy wrappers controlled burn rate and tar delivery by combining high basis weight and low porosity with small particle calcium carbonate filler and burn retardants. As the wrappers burn, the additives react with the calcium carbonate filler to form a barrier behind the char line which PM refers to as a "ceramic shield." The ceramic shield causes pressure to increase within the tobacco rod. The pressurized smoke is unable to escape through the low porosity wrapper. Some of the particulate matter attaches to the inside of the extra-heavy wrapper where it is repyrolized. The precise science of the two-ply wrapper was not proven at trial, but the parties agree that the two-ply wrapper was able to reduce some of the cigarette's visible sidestream smoke as well.

Cigarette paper wrappers are used primarily to contain the tobacco in the form of a rod by overlapping the edges of the paper around the circumference of the quantity of tobacco and sealing the seam with glue. Cigarette paper wrappers may provide other advantages or have other features in addition to their basic structural function in a cigarette. The two-ply and extra heavy wrappers are each wrappered about a cut tobacco filler to form a tobacco rod which is then formed into a finished cigarette. The "cigarette paper wrapper" of the '615 patent is also wrapped about a cut tobacco filler to form a tobacco rod which is then formed into a finished cigarette.

D. THE CIGARETTE INDUSTRY AS OF 1985

A person of ordinary skill in the art of cigarette design in 1985 would have held a bachelor's degree in engineering, chemistry, physics, or chemical engineering, and would have worked for a minimum of five years in the field of cigarette design.

In 1985 there were a number of cigarettes on the market with a circumference of 20 to 21 mm which had a static burn rate of 25 to 45 mg min^{-1} and would meet the improved tobacco utilization efficiency (TUE) mandated in the '615 patent. These cigarettes included the More and Dawn cigarettes marketed by the R.J. Reynolds Tobacco Company in 1974 and 1975 respectively, the Eve brand marketed by the Liggett Tobacco Company in 1976, and the L.T. Brown marketed by Lorillard in 1975. These cigarettes contained approximately 750 to 830 mg of tobacco. They did not utilize significantly less tobacco per cigarette than the orthodox 25 mm circumference cigarettes.

The More cigarette satisfied all elements of Claims 1, 4, and 11 of the ' 615 patent except circumference. The More cigarette had a circumference of 20.8 mm, a packing density of 263 mg/cm^3, and a static burn rate between 39 and 42 mg min^{-1}. It delivered one puff for every 53 mg of tobacco. At 20.8 mm, More fell outside the 10 to 19 mm range, but had a smaller circumference than the typical or orthodox 23 to 25 mm cigarettes then on the market. The More cigarette sold and has continued to sell successfully for the R.J. Reynolds Tobacco Company.

B & W marketed the Phoenix and Suede cigarettes in the mid-1970s after R.J. Reynolds brought out the More. The Phoenix was 21.2 mm in circumference; the Suede was 21 mm. These cigarettes had static burn rates outside the claimed range of the '615 patent.

By 1985, 96% of all cigarettes on the market employed a filter. Filtered cigarettes were generally the standard at that time. Therefore, cigarettes of commercially acceptable quality would have employed a filter.

Researcher Barbro Goodman of PM conducted a survey of cigarette papers on the market between May, 1985 and March, 1988 in an attempt to define what was typically in use at the time.. She found that these wrappers had the following characteristics:

1. A filler composed of large calcium carbonate crystals with a surface area of 7 to 10 square meters per gram. FN1

FN1. Fillers impart structure and color to the paper.

2. A basis weight of 23 to 26 grams/M ^{2} and thickness of .033 and .037 mm. FN2
FN2. "Basis weight" is the weight of one square meter of paper.

3. Contained no burn rate retardant chemicals.
The Benson & Hedges Russian No. 1 and Russian No. 3 cigarettes were marketed in the United States in the 1940s and 50s. These cigarettes had circumferences of 19.6 and 20.0 mm respectively, and utilized a hollow cigarette holder instead of a filter. The packing densities of these cigarettes fell outside the 200 to 300 mg/cc range of Claim 4 of the '615 patent. These cigarettes were somewhat of an oddity. Further, there is little reliable data on the static burn rates of these cigarettes.

All of the cigarettes identified above were sold in the United States prior to 1985.

In the 1960s, a subsidiary of BAT, the parent company of B & W, manufactured the unfiltered cigarette called the Ten Cent.

The Ten Cent had a circumference of 17.8 mm. This cigarette was sold primarily in Africa. There has been no showing that the Ten Cent was known or used by others in this country before the Luke invention. The evidence offered by PM of the Ten Cent's existence in the United States consisted of two instances. One was an open package of the cigarettes kept in a desk drawer of a New York manufacturer and importer of cigarettes, Panos Georgopulo. This package of cigarettes had remained in Georgopulo's drawer since the 1960s when the package was given to him. Mr. Georgopulo did not import the cigarettes nor offer them for sale to the public. He did not display the cigarettes for the public to see nor did he smoke them himself. There was also a specimen of a Ten Cent cigarette in the private collection of Dr. Robert Kaufman, a retired physician, who lived in New York City. He maintained the collection in his home which was not open to the public. The existence of his collection was not advertised to the general public. Kaufman cataloged the content of his collection at some point, and donated the manuscript to the New York Public Library. The Kaufman manuscript has been kept in the Arents Collection in the library. It is indexed in the card catalog only by the name of the author, and the manuscript itself is not made available to the general public. Further, the manuscript does not disclose any information about the physical characteristics of the cigarettes in the collection.

There were a number of research reports and articles in existence prior to 1985 relating to reduced circumference cigarettes.

In December, 1970, R.L. Rice of the Imperial Tobacco Company, a Canadian subsidiary of BAT, published an article entitled "A Weight Loss Technique for Determining Rate of Static Burn," in *Tobacco Science,* 1970.

The Rice article taught that a linear relationship existed between circumference and static burn rate for cigarettes in the range of 23 to 27 mm in circumference. The article stated that, for a given blend and paper type, the static burn rate for that cigarette expressed as weight loss/unit time is directly proportional to the cigarette's circumference. Rice provided a formula for calculating static burn rate for a cigarette by utilizing the known parameters of another cigarette of the same tobacco blend and paper. What has become known as the Rice formula is as follows:

Static burn	=	circumference of new	X	static burn

rate		cigarette		rate
(new cigarette)		circumference of known cigarette		(known cigarette)

This formula provided a person skilled in the art with the knowledge that a linear relationship existed between static burn rate and circumference thus teaching that static burn rates could be mathematically predicted. The Rice formula taught one skilled in the art of cigarette design that for a given cigarette, a change in its circumference would result in a static burn rate which could be predicted by multiplying the burn rate of the given cigarette by the ratio of the circumferences of the given and the new cigarettes. Rice's test data dealt with cigarettes between 23 and 27 mm in circumference. Rice did not limit application of his formula to cigarettes of these circumferences, nor did he propound that his formula applied to all circumferences. A person skilled in the art of cigarette design could obtain theoretical data points by applying the formula. Whether cigarettes could be made successfully, however that term might be defined, with static burn rates and circumferences in ranges other than 23 to 27 mm would necessarily be subject to experimentation by the cigarette designer. The Rice article establishes that burn rates in the range claimed in the '615 patent for cigarettes of 10 to 19 mm in circumference was not unexpected by one skilled in the art of cigarette design at the time of Luke's invention, although Rice himself did not test the 10 to 19 mm circumference range.

Cigarette technology is a complex, interdisciplinary science. It was well known in the art of cigarette design that a variety of parameters could be varied in order to achieve targeted burn rates and puff counts. The art of cigarette design requires that designers possess an understanding of a large number of interactive and dynamic factors which impact the ways in which a cigarette performs.

In 1977, Dr. Frank Resnick, then Director of Research at PM, published an article entitled "Factors Affecting Static Burn Rate" in *Tobacco Science*. Like the Rice article, the Resnick article taught that static burn rate is directly proportional to circumference, restating that principle taught in Rice. Resnick provided additional experimental data for cigarettes in the range of 23 to 27 mm in circumference.

Resnick also taught the concept of improved TUE, although in his article it was not so named. He stated that, all other parameters being kept constant, a reduction in circumference resulted in a greater percentage reduction in tobacco weight than percentage reduction in puff count. That is, that as circumference decreases, the grams of tobacco consumed per puff decreases. Luke defined TUE as the total tobacco weight divided by the number of puffs yielded from the cigarette. Resnick's finding was that TUE improves as circumference is decreased. Resnick's finding that puff count was not sacrificed as rapidly in comparison to tobacco weight when cigarette circumference was reduced provided a motivation to those skilled in the art of cigarette design in 1977 to pursue reducing the circumference of cigarettes in order to reduce the overall cost of manufacture by using less tobacco per cigarette.

In 1981, M. Muramatsu of the Japan Monopoly Corp., Tokyo, published an article entitled "Studies on the Transfer Phenomena in Naturally Smouldering Cigarettes," *Nippon Senbai Kosah Chuo Kenkyusho,* Vol 123, pp. 9-78 (1981) (translation). The Muramatsu article also taught Rice's linear relationship but in the range of 20.2 to 26.9 mm in circumference for tested cigarettes. Muramatsu also included a theoretical date point at 18.8 mm in circumference which suggests that the linear relationship (which can be plotted mathematically based upon the Rice formula) will extend at least to that theoretical point. It is true that this is a hypothetical point, rather than an experimental one. Muramatsu offers no test data on an 18.8 mm circumference cigarette. It is also true that there is no explicit statement in the article that the linear

relationship extends below 18.8. However, this 18.8 mm data point, albeit a theoretical one, exists in this piece of literature. The linear relationship between circumference and mass static burn rate previously set out in Rice and Resnick is utilized in the Muramatsu article. We cannot presume that the inclusion of the data point by Muramatsu was without purpose or scientific reason. We cannot read into its inclusion any more than that the linear relationship was thought by Muramatsu, in theory, to extend to 18.8 mm cigarettes. Such a thought, however, would suggest to one skilled in the cigarette design art that extrapolation was possible down to 18.8 and, according to Muramatsu, theoretically probable. The extrapolation is, as noted previously, an extension of the scientific data less than 1.5 mm below the smallest tested circumference. The extrapolation cannot be inferred for circumferences below the theoretical data point offered by Muramatsu, despite the linear relationship. There has been no testimony offered to establish that the linear relationship holds for all circumferences, and no party has made such a suggestion.

If it had not occurred to one skilled in the art of cigarette design that a commercially acceptable cigarette of 10 to 19 mm was feasible, it was suggested as a feasible concept by Muramatsu, insofar as the resulting static burn rate range was suggested in theoretical data points for a cigarette within the range of 10 to 19 mm.

The two attorneys who were involved with the prosecution of the '410 and '615 patents were Kenneth John Hanson MacLean ("MacLean"), patent agent for BAT, Southampton, England, and Charles Granville Lamb ("Lamb"), patent and trademark counsel for B & W. The U.S. patent applications were drafted and prosecuted by Lamb in consultation with MacLean and Luke.

From time to time, MacLean brought information to Lamb's attention during the course of the prosecutions, in an effort to bring pertinent materials to the examiner.

By sometime in November of 1987, MacLean had made a preliminary review of the Resnick article and had determined that it was not pertinent to the Luke cigarette. MacLean testified:

The Resnik document was brought to my attention, as I said, in regard to the German proceedings. The material entered the proceedings by way of a third party submission. I recollect that the German agents acting on behalf of the submitting party submitted to the German Patent Office a diagram which had reference to a figure 9 of Resnik. In my preliminary view of Resnik, I observed a number of things in respect of figure 9. One was that it did not have a proper origin, figure 9 being in the form of a graph. This gave a misleading picture of the data points presented in the graph. When these were drawn. .... I correct myself. When these were placed upon a correctly drawn graph, with a true origin, it was observed that the data points of figure 9 constituted a compact cluster which was distant from both the vertical and horizontal axis and, of course, from the true origin. Moreover, the cluster of data points circumference-wise related to conventional cigarettes. The lowest circumference was on the graph or in the accompanying text. It was about that mentioned in the preamble of the Luke specification and the corresponding static burn rate was again approximately that mentioned in the preamble of the Luke specification. The text associated with the graph defined what the authors meant by "slim cigarettes" as being cigarettes of 22 to 23 millimetre *[sic]* circumference. My scientific colleagues, including John Luke, had stressed to me that the extrapolation indulged in the diagram submitted in Germany was bad science.

MacLean depo., pp. 124-25. He concluded that "[a]t the time when I read Resnick, it was clear to me and has since remained clear to me that Resnick and his co-authors confined themselves to conventional cigarettes and I make no speculation about cigarettes other than conventional cigarettes as I believe is

indicated in the last paragraph of their paper." MacLean depo. at p. 133.

Lamb also reached the same conclusion with respect to the Resnick article:

The information that I had on this was that this reference was irrelevant to the prosecution of the Luke reissue application, and I subsequently verified that upon review of this article some time after being advised of it.

Lamb depo., p. 8. He explained:

In discussion with MacLean there were two things that came to mind that I recalled, and that was that the article did not teach or relate to a circumference of less than 22 millimeters, and it did not teach a burn rate of-I don't recall the number, but it did stick in my mind. It was less than 60. Subsequent to that time, when I did review the article, I had the same conclusion.... I do recall a caveat at the end of this that very specifically says, "This paper is intended as a survey of the extent to which various cigarette parameters affect the static burn rate." ... For this reason, the authors have refrained from speculation about the mechanisms which certain parameters influence the burning.

Lamb depo. pp. 14-16.

In 1983, Dr. Alex W. Spears, then Executive Vice President of Operations and Research at Lorillard Co., again confirmed the Rice formula in his article entitled "A Technical Analysis of the Problems Relating to Upholstered Furniture and Mattress Fires Relative to Proposed Cigarette Legislation Including a Review of Relevant Patents." Dr. Spears' article represented the results of an industry study group and was presented to the Subcommittee on Health and the Environment of the Committee on Energy and Commerce of the United States House of Representatives. Spears taught that the approximate point of self-extinction of a cigarette occurs at a linear burn rate of 2 to 3 mm/min.

Spears noted that, at the time of his article, the linear burn rate of most commercial cigarettes was 5 to 7.5 mm/min.

B & W offered some testimony that it was the conventional wisdom, prior to Luke's invention, that a cigarette in the range of 10 to 19 mm would "burn up like a fuse" or would not be capable of sustained smoulder or would be otherwise commercially unacceptable. However, the literature of Rice and Muramatsu, coupled with the existing cigarettes in the industry would have suggested otherwise to one skilled in the art of cigarette design. We have already noted that Rice taught that the linear relationship between circumference and static burn rate could be calculated down to 23 mm, and Muramatsu suggested an extension of that relationship down to 18.8 mm. The existing cigarettes in the industry prior to Luke's invention included thin cigarettes in the area of 21 mm. The L.T. Brown, Dawn, and Eve cigarettes ranged in circumference from 20.7 mm to 21.2 mm and were sold commercially in the United States prior to the Luke invention. Finally, the More cigarette, manufactured by R.J. Reynolds Tobacco Company beginning in 1975 and continuing to the present, has a circumference of 20.8 mm. These cigarettes evidence the efforts and related successes in designing commercially acceptable cigarettes of reduced circumference. None of the cigarettes is within the 10 to 19 mm range. However, the literature teaching the relationship necessary to discern that acceptable static burn rates could be achieved in the claimed range coupled with the market successes of cigarettes as slim as 20.7 mm (slightly over 1 1/2 mm larger than the high end of the patented range) would teach one skilled in the art of cigarette design that a commercially acceptable cigarette could

be manufactured in the 10 to 19 mm range of circumferences. The presence or absence of filters on any of the experimental cigarettes tested in the Rice, Resnick, Muramatsu, or Spears articles is of no significance. A filter has no affect on the static burn rate test.

Contrary to the assertion of B & W, the machinery in existence at the time of Luke's invention was equipped for change parts, enabling a manufacturer to use existing machinery to manufacture reduced circumference cigarettes. The manufacturability of circumferences as slim as 15 mm was specifically pointed out.

The Molins Machine Company, a leading manufacturer of cigarette making machines, sold its Mark V and Mark VI from the 1930s through the 1970s. Many cigarette companies used machines manufactured by Molins to produce their cigarettes. Molins introduced its Mark V machine in 1932 and continued to sell it until 1964. Change-out garnitures were available to facilitate the manufacture of small circumference cigarettes, and Molins advertised the availability of these garnitures in its brochures: "Change-over operation from one size to another is of a minor nature and may be carried out with ease and rapidity." These garnitures could accommodate circumferences as small at 15 mm. These machines were capable of producing 1,200 to 1,300 cigarettes per minute for commercial production.

In Molins' promotional publications, the company represented to the tobacco industry that by "the use of change parts a wide range of round or oval cigarettes may be manufactured ... from 15 mm to 30 mm in circumference for round cigarettes." DX 1154.

The Molins brochure was published in the 1930s. It made it clear that change parts were available to manufacture cigarettes as thin as 15 mm in circumference. The manufacturing capability was thus readily available, and the availability of the technology would have been known to those who were engaged in the commercial manufacture of cigarettes.

In 1984, the *Yamamoto/Beitrage* publication taught that "a reduction in the amount of smoke generated is expected with decreasing circumference, because both the puff count ... and the weight loss during a puff ... decrease." PX 822. The article also taught that puff count is "nearly proportional to the radius of the cigarette." PX 822.

In 1978, Marlan Z. Debardeleben, Warren G. Claflin, and Walter F. Cannon from the Philip Morris Research Center in Richmond, Virginia, authored an article entitled "Role of Cigarette Physical Characteristics on Smoke Composition," published in *Recent Advances in Tobacco Science*. In the article, the authors note:

A decrease in the circumference of a cigarette, with packing density remaining constant, reduces the weight of a cigarette and the available tobacco to be burned. It also increases the rate of burn as expressed in mm burned per minute and decreases it in mg consumed per minute ... Puff count is consequently decreased, too. For example, experiments at Philip Morris ... have shown a decrease in puff count of about 19% with a 15% decrease in circumference. Such a change in circumference also causes an increase in pressure drop.

PX 100A.

Yamamoto/Beitrage and Debardeleben were provided to the PTO. The Debardeleben and Yamamoto articles did not teach the linear relationship between static burn rate and circumference, however. Therefore, the later articles are not cumulative to Rice, Resnick, and Muramatsu.

The patent to Strydom, United States Patent No. 4,903,712 issued in February of 1990, taught a method for reducing tobacco weight or cost through an annularly configured cigarette. The application was filed June 13, 1989. Earlier applications were filed in December, 1985 and June, 1987 but were abandoned. The earliest date which can be relied upon for constructive reduction to practice by Strydom is June 13, 1989. This patent was filed and published after Luke's invention, and is therefore not prior art. The Sterr patent (German Gebrauchsmeister Utility Model Patent No. 1,926,149) was issued in September of 1965. It was cited by the patent examiner in the references for the '615 patent. The German Utility patent describes cigarettes, filtered and unfiltered, in a range of circumferences from 15.7 to 25 mm. While the patent described reduced circumference cigarettes in the range of the Luke patent, it did not provide any information regarding packing densities, burn rates, TUE or other characteristics of the cigarette. It described the cigarette simply as consisting of a paper tube 5 to 8 mm in diameter, made of a fine paper (cigarette paper) filled with ripened, dried, and finely cut tobacco, possibly chemically treated, and possibly including a filter. The patent served to show only that Sterr conceived of thin cigarettes as early as 1965, but it did not teach those skilled in the art about the smoking dynamics of thin cigarettes.

"Tobacco utilization efficiency," or "TUE," was a phrase coined by Luke in the '615 patent. Luke's premise was that orthodox cigarettes burned tobacco inefficiently. A cigarette weighing 884 mg, for example, with a circumference of 25 mm and a combined tobacco rod and filter length of 84 mm (64 mm tobacco rod; 20 mm filter) yielded 9.3 puffs per cigarette. TUE is measured, according to Luke, by determining the weight of the tobacco consumed per puff. The TUE for the orthodox cigarette described in the '615 patent is 95 mg per puff. The TUE of the More was 53 mg/puff, Dawn was 58 mg/puff, L.T. Brown was 55 mg/puff, Eve was 58 mg/puff, Phoenix was 65 mg/puff, and Suede was 65 mg/puff. These TUE values were at least 32% better than the orthodox cigarette described in the '615 patent.

The value of the discovery, in Luke's eyes, is the increased efficiency with which the tobacco is burned, which allows for the reduction in the weight of the tobacco utilized in the cigarette. The weight reduction is not an element of the invention, however. It is a subsidiary benefit of the improved TUE. A cigarette made according to the claims of the '615 patent may in fact use less tobacco, which Luke espoused as its achievement. However, it is the science of the increased efficiency in burning which is the invention we must evaluate. B & W would have the court discount the value of the More and More-type cigarettes on the basis that their tobacco weight was not significantly less than the orthodox 25 mm cigarettes. B & W urges that the More did not achieve the goal of the '615 patent. The More utilized approximately 7% less tobacco than the orthodox cigarette identified in the table in the '615 patent.

It is TUE which is taught in the '615 patent as the Luke invention, and which permits a reduction in tobacco weight at smaller circumferences. In reading the patent in its entirety and considering the patented invention as a whole, it is not merely a slimmed down rod which is claimed, but rather it is the improvement in the burning efficiency which exists in the slimmed down design which is the discovery claimed by Luke.

The benefit of tobacco weight reduction is promoted in the specification:

Cigarettes according to the present invention, as well as being of elegant appearance, utilize tobacco with increased efficiency. Thus a cigarette may be provided according to the present invention which, compared with a cigarette of orthodox dimensions ... comprises considerably less tobacco ... and yet which provides an equal, or even greater number of puffs. The actual number of puffs, will, of course, be dependent inter alia upon the length of the cigarette.

'615 patent, col. 1, lns. 53-62.

Claims 1, 4, and 11 do not mention tobacco weight, nor do the particular parameters which are provided in the claims lead one skilled in the art to utilize particular tobacco weight.FN3

FN3. Claim 10 specifies a 25% reduction in the amount of tobacco utilized over that utilized in conventional commercially marketed cigarettes. '615 patent, col. 4, ln. 22-25. Claim 12 and related Claims 14, 15, and 16 similarly provide for a particular weight by limiting the circumference of the rod to 15 to 17 mm and the length to 100 mm, in conjunction with the filler packing density of 150 to 350 mg per cm^3. It would be redundant to provide a weight element in these dependent claims if the element was incorporated in Claim 1. Claims 10, 12, 14, 15, and 16 are not in issue in this action.

We are required to determine whether the increase in tobacco utilization efficiency over an orthodox cigarette which results when a cigarette is made according to the invention was obvious to one skilled in the art at the time of the invention. The More cigarette achieved improved tobacco utilization efficiency, as was taught by the '615 patent. It is simply not as small a cigarette. The existence of the successful More cigarette, which achieved a whopping 15.4 puffs per cigarettes at the reduced circumference of 20.8 mm, makes apparent the fact that those skilled in the art of cigarette design were aware that the circumference of an orthodox cigarette could be reduced while *increasing* the number of puffs yielded from the cigarette. The TUE of the orthodox cigarette (95) was improved in the More to 47.1. This is a comparable increase in the efficiency of the utilization of tobacco to the cigarettes A and B in the table in the '615 patent which Luke found were significant improvements in the burning efficiency of a cigarette. The TUE of the reduced circumference rods A and B were 39.63 and 47 .10 respectively. The difference between the More cigarette and Luke's cigarettes A and B is the way in which the improved TUE is utilized. With samples A and B, the weight of the tobacco in the cigarettes was reduced yielding approximately the same or slightly more puffs. With the More, the tobacco weight was kept the same and the number of puffs was increased substantially. What permitted the reduction in tobacco weight or the increase in puff count was the more efficient utilization of the tobacco which occurred at the reduced circumference.

Rice, Resnick, and Muramatsu taught static burn rates for reduced circumference (less than 25 mm) cigarettes, Muramatsu suggesting a theoretical data point for a circumference of 18.8 mm. Thus reductions in circumference were considered, tested, and the relationship between circumference and mass static burn rate had defined and published at the time of Luke's discovery. Clearly, those skilled in the art knew that circumference could be reduced from 25 mm to as small as 20.8 with reliable smoulder, improved puff count as shown by the More, and meeting the requirements for a marketable finished product. The question then is whether the reduction below 20.8 mm was obvious and whether there was motivation to pursue it. At least Muramatsu thought that further reduction to 18.8 was possible and he so documented his theory. Reduced circumference cigarettes were selling well in the market at the time. Resnick suggested what had actually been shown by the More cigarette, that is, that adequate puff count could be maintained while reducing the circumference of the rod.

Most cigarettes on the market in 1985 consisted of an elongated rod of uniform cross-section throughout its length, were capable of sustained smoulder when lit but not being puffed, used a cut tobacco filler, utilized a cigarette paper wrapper, had a tobacco packing density of 200 to 300 mg per cm^3, and employed a filter attached to the rod of tobacco with a tipping paper.

The commercial embodiment of the '615 patent is B & W's Capri cigarette which was introduced into the United States market in January of 1987. The Capri cigarette is a filtered cigarette, 17 mm in circumference, containing approximately 450 mg of tobacco, with a packing density of about 280 mg per cm^3 and a free mass burn rate of about 35 mg min^{-1}, and delivering approximately 8.5 to 9 .5 puffs per cigarette. Capri obtained approximately a 0.5% market share in the United States. In female cigarette brands, it was the first in a new subcategory of cigarette-the ultraslim products. B & W had a share objective for its Capri (1%) which has never been realized. The three-month period prior to the trial of this action realized an average market share of 0.64%.

B & W's marketing of the Capri cigarette included free carton giveaways and $2.50 off carton coupons. It promoted the brand with targeted marketing, developing feminine imagery through its packaging and advertising. B & W created a "unique," "clean-looking," and "very feminine" packaging at great expense.

E. PM'S INTRODUCTION OF THE VSSS CIGARETTE

After Capri's entry into the market, there were assessments of it by various individuals at PM referring to it as "unique," "a radically novel product," "atypical from all commercial cigarettes on the market," possessing "uniqueness and innovativeness in the marketplace," and finding Capri's size to be "astonishing." PX 915; PX 38

In April of 1987, PM began considering its response to Capri's entry into the market:

SUMMARY

-> Capri's Ultra Thin produce could negatively impact Virginia Slims volume when rolled nationally
-> Young female 100/120 mm low tar menthol smoker major source of business

-> Package design key to trial

-> Good taste and product thinness key to repeat

-> Greatest opportunity to counteract Capri threat is to:

-> Take an offensive stance

-> Market the product as a flanker to the brand

-> Create a cigarette with a taste and look profile identical to Capri

-> Design a package which competes directly against Capri: clean, feminine, cosmetic

-> Execute creative around key benefit of: "X" Thins from Virginia Slims makes you feel graceful and ladylike

PX 607.
On July 13, 1987, the law firm of Fish & Neave gave PM a written opinion concerning, among other things,

the validity of Luke's '410 patent.

Luke began the process of applying for reissue of the '410 patent. Prosecution of the '615 reissue application was closed on October 27, 1987.

On January 15, 1988, a German counterpart application was rejected by a German patent examiner on the basis of the Resnick article as prior art. He concluded that nothing precluded extrapolation of the data points in Resnick to predict the static burn rates of cigarettes with smaller circumferences. The German examiner acknowledged the Rice linear relationship of static burn rate to circumference.

Resnick had not been cited to the examiner in the United States reissue proceedings, nor had the More or the so-called More clones (Dawn, Phoenix, Suede, L.T.Brown, Eve), on the basis that these references did not constitute material prior art.

On March 8, 1988, the '615 Reissue patent issued. It contained additional prior art references, added eleven claims, and added new elements to all of the claims which were contained in the '410 patent.

On March 24, 1988, Fish & Neave obtained a copy of the file wrapper for the ' 615 patent.

On April 7, 1988, a teleconference was held with representatives of PM and members of the Fish & Neave firm. Witnesses for PM testified that during that teleconference, Fish & Neave gave oral opinions regarding validity and infringement with respect to the reissue patent. The contemporaneous documentation does not indicate that such opinions were given. The documentation seems to suggest that the file wrapper was reviewed and legal opinions were formed over a period of time beginning after April 7, 1988.

PX 1333 Fish & Neave billing records contain the following entries during the pertinent time period:

04/07/88	Mark Bloomberg	Review of reissue file and meeting with Messrs. Bailey, Fey and Schardt
04/07/88	Albert Fey	Meetings with Schardt, and Bailey, et al
04/07/88	Edward Bailey	Review reissue file wrapper; meeting with Mr. Schardt and Bloomberg in preparation for meeting at headquarters to consider possible Swiss nullity proceeding
04/07/88	Mark Bloomberg	Meeting at Philip Morris and review of file wrapper
04/08/88	Mark Bloomberg	Meeting at Philip Morris and review of file wrapper
04/08/88	Edward Bailey	Attended meeting at headquarters with Messrs. Fey, Newman, Schardt and Pollak (with Bloomberg) re status, including initial review of reissue file wrapper and re possible Swiss nullity proceeding; follow-up after meeting
04/11/88	Mark Bloomberg	Review of reissue file
04/12/88	Edward Bailey	... review reissue file wrapper
04/15/88	Edward Bailey	Review reissue file wrapper

04/18/88	Edward Bailey	Review reissue file wrapper to consider invalidity ...
04/19/88	Edward Bailey	Consider impact of reissue on opinion re invalidity ...

DX 1037 Diary of Albert Fey contains the following entry:

1 1/2 PM (Capri patent)

Disc TLS; tele Schardt; give opinions regarding validity and infringement of Re patent

PX 1333 Fish & Neave billing records contain an entry for Fey on that date:

03/03/89	Albert Fey	Discussion with Mr. Secrest; telephone Schardt; giving opinions regarding validity and infringement of Reissue patent.

There is also an entry for Bailey for his participation in that conference:

03/03/89	Edward Bailey	Conference with Messrs. Secrest and Fey re opinion to Philip Morris ...

This oral opinion which was given in 1989 is clearly documented, and many hours of review and preparation precede the March 3, 1989 conference. There is a marked absence of such contemporaneous documentation for the purported oral opinion of April 7, 1988.

Another oral opinion was given, or the previous oral opinion was reiterated, on May 11, 1989. The contemporaneous documentation for this conference consists of DX 1022A, a legal outline entitled "Outline for Conference with Mr. Scinto-5/11/89." The outline details the legal opinions regarding validity, enforceability, infringement, and other matters with respect to the reissue patent. There are billing notations (PX 1333) documenting preparation for and participation in the May 11, 1989 conference. Billing entries from March 3, 1989 forward continue for Albert Fey, Charles Smith, Edward Bailey, Thomas Secrest, and John Schneider documenting work on the PM matter almost daily. After the decision to obtain an opinion from a second patent law firm, Fitzpatrick, Cella, Harper & Scinto, the billing records (PX 1333) document preparation for a meeting with Schardt of PM and Scinto from the Fitzpatrick Cella firm:

05/04/89	Albert Fey	Discussion Secrest and Tramontine; telephone Palmer and Schardt; telephone Scinto; setting up 2nd opinion; working on F & N opinion.
05/08/89	Albert Fey	Telephone Schardt; telephone Scinto; discussion Bailey and Schneider; preparation for meeting. Reviewing opinions.
05/09/89	Albert Fey	Meeting with Palmer, Bailey and Secrest; preparation for opinion meeting with Scinto working on opinion; telephone Scinto.
05/09/89	John Schneider	Prepare outline for conference with Mr. Scinto. Review material sent to Mr. Scinto. Revise opinion letter.
05/10/89	Albert Fey	Discussion Bailey, Secrest and Schneider; preparation for Scinto meeting; reviewing letters and opinion.
05/10/89	John	Revise outline for conference with Mr. Scinto & Mr. Schardt. Draft case

	Schneider	summaries. Conference with Messrs. Bailey, Secrest and Fey re: conference with Mr. Scinto. Draft discussion of German Utility Model reference. Prepare conference with Mr. Scinto.
05/11/89	Albert Fey	Meeting Scinto, Schardt, Bailey and Schneider; reviewing patent situation.
05/11/89	John Schneider	Prepare for conference with Mr. Schardt and Mr. Schardt [sic]; attend conference with Messrs. Schardt, Bailey, Fey and discussed Capri opinion. Review Exhibits to BAT's brief in Switzerland.
05/11/89	Edward Bailey	Conference with Messrs. Fey, Schneider in preparation for meeting with Messrs. Scinto and Schardt to provide Scinto with background information for second opinion; review and consider our opinion.

B & W contends that a decision to launch VSSS was made as early as March 14, 1989, relying on PX 809 as evidence of this proposition. PX 809 is a memorandum dated March 20, 1989, consisting of the minutes of the March 14, 1989 Corporate Products Committee meeting. The minutes contain the following paragraph:

Virginia Slims Superslims:

-> Ad/Pack produced and shipped to field on March 2, 1989.
-> Packaging designs still being evaluated.

-> Current plans are not to test market. Instead plan to go with a national launch in September.

There is nothing in the language of this paragraph which indicates that a decision was made at that time regarding the launch date. The language "Current plans are ... Instead plan to ..." suggests a work in progress. This court is unconvinced that a launch date was firmly established in mid-March, 1989.
In PX 809, a Request for Machine Made Experimental Cigarettes form indicates that on February 24, 1989, 598,000 VSSS were manufactured. Sixteen thousand of those cigarettes were shipped in ad/packs for consumer testing on March 2, 1989. A Sales and Finished Goods Cost Analysis Report (PX 1170) establishes that 672,000 VSSS were manufactured in June of 1989. The parties further agree that PX 1170 establishes the manufacture of 12 million VSSS cigarettes in July of 1989.

On July 25, 1989, PM received the written opinion from Fitzpatrick Cella (DX 755A). On August 11, 1989, PM received the second written opinion from Fish & Neave (DX 766A).

CONCLUSIONS OF LAW

B & W alleges that its '615 is infringed by the VSSS cigarette and that PM has infringed willfully. PM counters, in addition to denying infringement, that the '615 patent is invalid and that it is unenforceable.

We will first address the allegations of invalidity, inasmuch as B & W cannot recover damages for infringement of an invalid patent. PM's assertion of invalidity is premised upon its contention that the Luke cigarette would have been obvious to one skilled in the art, and that it had been in public use more than one year prior to Luke's patent application.

In addressing obviousness, the court must determine (1) what prior art was in existence, (2) what

qualifications would be possessed by a hypothetical person skilled in the art, (3) what is claimed in the patent in issue, and (4) whether what is claimed would have been obvious to the hypothetical skilled person who is charged with knowledge of the prior art.

The claims of the patent must be interpreted for purposes of our infringement analysis as well. The court must determine whether the claims, as properly interpreted, cover the accused device or process. We will address both literal infringement and infringement under the doctrine of equivalents.

The court then must assess the conduct of B & W in the proceedings before the PTO in determining whether the court should make the patent unenforceable. The court must evaluate whether B & W has made and (a) misrepresentations of material fact, (b) failures in disclosure of material information, or (c) submissions of false material information, coupled with an intent to deceive the PTO, as alleged by PM.

Finally, if the court determines that PM has infringed the '615 patent, we must decide whether PM acted willfully in so doing. The court must evaluate PM's conduct in this regard. We will address this matter as the last order of business in this opinion.

A. OBVIOUSNESS

PM does not contend that Claims 4 and 11 of the '615 patent are invalid for anticipation under 35 U.S.C. s. 102, as no single piece of prior art contained every feature recited in those claims.

PM does contend, however, that the purported invention of the '615 patent was obvious in light of the prior art and therefore the '615 patent should be declared by this court to be invalid. There cannot, of course, be any recovery for infringement of an invalid patent.

Following examination by the Patent and Trademark Office, a duly issued patent is presumed valid, as is a duly reissued patent. The burden of proving otherwise resides with the person challenging its validity. 35 U.S.C. s. 282. This statutory presumption derives in part from recognition of the technological expertise of the patent examiners. A reissue application receives a fresh examination, normally concentrated on those references and reasons that occasioned its filing.

Interconnect Planning Corp. v. Feil, 774 F.2d 1132, 1139 (Fed.Cir.1985).

The burden rests on PM to establish that a particular patent, product or article was relevant and material prior art.

While the ultimate question of patent validity is one of law [citation omitted], the s. 103 condition, which is but one of three conditions, each of which must be satisfied, lends itself to several basic factual inquires. Under s. 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. Against this background, the obviousness or nonobviousness of the subject matter is determined. 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. As indicia of obviousness or nonobviousness, these inquiries may have relevancy.

Graham v. John Deere Company of Kansas City, 383 U.S. 1, 17-18, 86 S.Ct. 684, 694, 15 L.Ed.2d 545

(1966). Accord, Akzo N.V. v. U.S. International Trade Commission, 808 F.2d 1471, 1480 (Fed.Cir.1986).

The obviousness determination is "a legal conclusion based on factual evidence." Stevenson v. International Trade Commission, 612 F.2d 546 (C.C.P.A.1979).

[T]he party asserting invalidity has the procedural burden of proceeding first and establishing a prima facie case, but the burden of persuasion on the merits remains with that party until final decision. The party supporting validity has no initial burden to prove validity, having been given a procedural advantage requiring that he come forward only after a prima facie case of invalidity has been made. With all the evidence in, the trial court must determine whether the party on which the statute imposes the burden of persuasion has carried that burden. Introduction of more pertinent prior art than that considered by the examiner does not, therefore, "weaken" or "destroy" the presumption. Nor does such introduction "shift" the basic burden of persuasion. The presumption continues its procedural, burden-assigning role throughout the trial. Such introduction can, of course, facilitate the validity challenger's carrying of that burden. It would require one supporting validity to come forward with countervailing evidence, as would the introduction of any evidence tending to establish invalidity. In the end, the question is whether *all* the evidence establishes that the validity challenger so carried his burden as to have persuaded the decisionmaker that the patent can no longer be accepted as valid.

Stratoflex, Inc. v. Aeroquip Corp., 713 F.2d 1530, 1534 (Fed.Cir.1983).

"The scope of the prior art has been defined as that 'reasonably pertinent to the particular problem with which the inventor was involved.' " Stratoflex, Inc. v. Aeroquip Corp., 713 F.2d 1530, 1535 (Fed.Cir.1983), citing In re Wood, 599 F.2d 1032, 1036 (C.C.P.A.1979).

We are required to make factual findings in our obviousness analysis:

In Loctite Corp. v. Ultraseal Ltd., 781 F.2d 861, 872, 228 USPQ 90, 98 (Fed.Cir.1985), the Federal Circuit elaborated [on the four factual inquiries set out in the *Graham* case to be conducted in determining obviousness under 35 U.S.C. s. 103]:

"In patent cases, the need for express *Graham* findings takes on an especially significant role because of an occasional tendency of district courts to depart from the *Graham* test, and from the statutory standard of obviousness that it helps determine, to the tempting but forbidden zone of hindsight."

Arkie Lures, Inc. v. Gene Larew Tackle, Inc., 119 F.3d 953, 955 (Fed.Cir.1997).

1. Prior art

The parties dispute what constitutes prior art for the '615 patent. The trial testimony addressed the characteristics of numerous cigarettes and explored the scientific premises of a number of articles and research papers.

The parties do not dispute that physical items, such as cigarettes on the market at the time of the invention, can constitute prior art. *See, i.e.,* LaBounty Mfg., Inc. v. U.S. Int'l. Trade Commission, 958 F.2d 1066, 1074-76 (Fed.Cir.1992). In fact, the Ten Cent cigarette manufactured by BAT was brought to the attention of the patent examiner in the prosecution of the '615 patent.

Luke took the position that the Ten Cent cigarette did not constitute prior art for his invention. He stated:

Upon information and belief the aforesaid pre-1974 "Ten Cent" brand cigarette was not known or used in the United States prior to my July 22, 1985 United States application filing date, and was not in public use or on sale in the United States, nor patented or described in any printed publication, more than one year prior to my aforesaid United States application filing date.

'615 patent prosecution history at p. 26, s. (12)(l).

With respect to the Ten Cent cigarette, we conclude that the two instances in which the cigarette was found in the United States do not constitute prior public use under 35 U.S.C. 102(b), nor was the Ten Cent known or described in a printed publication here.

The purpose behind the publication bar of 35 U.S.C. s. 102(b) is informative:

The publication bar of 35 U.S.C. s. 102(b) ... operates upon the theory that the invention in controversy is in the public domain, and once there, is no longer patentable by anyone ... As stated in In re Tenney, supra, 254 F.2d at 626, 45 C.C.P.A. at 902, 117 USPQ at 354, "the public is not to be charged with knowledge of a subject until such time as it is available to it."

In re Bayer, 568 F.2d 1357, 1361-62 (C.C.P.A.1978).

Panos Georgopulo did not import Ten Cent cigarettes nor did he offer them for sale, even though he engaged in the business of importing cigarettes. He kept a single open pack concealed in a desk drawer for over thirty years. These cigarettes were not displayed nor were they smoked.

Dr. Kaufman maintained a specimen of the Ten Cent in his private collection of cigarettes in his home. He did not make the collection accessible to the public, nor was the existence of his collection advertised.

Although he cataloged the contents of the collection, the Kaufman manuscript does not constitute a prior art printed publication concerning the Ten Cent.

In In re Bayer, 568 F.2d 1357, 1361 (C.C.P.A.1978), the court stated:

We think it apparent that a printed document may qualify as a "publication" under 35 U.S.C. s. 102(b), notwithstanding that accessibility thereto is restricted to a "part of the public," so long as accessibility is sufficient "to raise a presumption that the public concerned with the art would know of (the invention)." [citations omitted] ... Since appellant's thesis could have been located in the university library only by one having been informed of its existence by the faculty committee, and not by means of the customary research aids available in the library, the "probability of public knowledge of the contents of the (thesis)," In re Tenney, supra, 254 F.2d at 629, 45 C.C.P.A. at 902, 117 USPQ at 354, was virtually nil.

We are faced with a similar scenario here. Dr. Kaufman donated his manuscript cataloging the contents of his collection to the New York Public Library. It was maintained in the Arents collection, and was not made available to the general public. It was indexed in the card catalog solely by the name of the author. Thus, prior knowledge of the existence of the manuscript and the identity of its author was required simply to

locate it in the library. *See also,* RCA Corp. v. Data General Corp., 701 F.Supp. 456, 468 (D.Del.1988), *aff'd,* 887 F.2d 1056 (Fed.Cir.1989).

Finally, it is significant that the manuscript disclosed no information about the physical characteristics of the cigarettes.

"With respect to the prior art printed publications, these references must be enabling, thus placing the allegedly disclosed matter in the possession of the public." In re Epstein, 32 F.3d 1559, 1568 (Fed.Cir.1994), citing Akzo N.V. v. United States Int'l. Trade Commission, 808 F.2d 1471, 1469 (Fed. Cir.1986, *cert. denied,* 482 U.S. 909, 107 S.Ct. 2490, 96 L.Ed.2d 382 (1987). The critical feature, the 17.8 mm circumference of the Ten Cent cigarette, was not disclosed by the Kaufman manuscript to the public. Therefore, we conclude that the Ten Cent was not known or used, in public use or on sale, nor described in any printed publication more than one year prior to Luke's United States application filing date.

PM cites a number of cases for the proposition that prior knowledge and use by a single person is sufficient to preclude patentability. Candela Laser Corp. v. Cynosure, Inc., 862 F.Supp. 632, 640 (D.Mass.1994), *aff'd without opinion,* 59 F.3d 181 (Fed.Cir.1995); Coffin v. Ogden, 85 U.S. 120, 124-25 (18 Wall. 120), 21 L.Ed. 821) (1873). However, we do not find a "use" here, either in Georgopulo or Kaufman.

PM contends that there was a prior public use of the '615 cigarette when B & W had the Kapular study performed.

Title 35, United States Code, Section 102(b) states that a person is not entitled to a patent if the claimed invention was in public use in the United States more than one year prior to the date of the application for patent in the United States.

A "public use" for the purpose of barring access to the patent system is a use more than a year before the patent filing date, whereby a completed invention is used in public, without restriction and in circumstances other than "substantially for the purposes of experiment." Smith & Griggs Mfg. Co. v. Sprague, 123 U.S. 249, 256, 8 S.Ct. 122, 125, 31 L.Ed. 141 (1887) ... The law recognizes that the inventor may test the invention, in public if that is reasonably appropriate to the invention, without incurring a public use bar ... The determination of these aspects requires considering and weighing such factors as the nature of the public use; whether there was any confidentiality obligation imposed on persons who observed the use; whether progress records or other indicia of experimental activity were kept; whether persons other than the inventor or acting for the inventor conducted the experiments; how many tests were conducted; the scale of the tests compared with commercial conditions; the length of the test period in comparison with tests of similar products; and whether payment was made for the product of the tests ... All of the circumstances must be considered. Baker Oil Tools, [Inc. v. Geo Van, Inc.], 828 F.2d [1558], at 1564 [(Fed.Cir.1987)].

Allied Colloids, Inc. v. American Cyanamid Co., 64 F.3d 1570, 1574-75 (Fed.Cir.1995).

Patent invalidity based on public use is required to be proved by clear and convincing evidence. Moleculon Research Corp. v. CBS, Inc. 793 F.2d 1261, 1266 (Fed.Cir.), *cert. denied,* 479 U.S. 1030, 107 S.Ct. 875, 93 L.Ed.2d 829 (1987). Invalidity under 35 U.S.C. s. 102(b) is an affirmative defense. The burden therefore is upon PM to establish it.

Although a written promise of confidentiality is a factor to be considered in appropriate circumstances, such

as when persons other than the patentee conduct the experiments [citations omitted], the absence of such a promise does not make a use "public" as a matter of law, or outweigh the undisputed fact that no information of a confidential nature was communicated to others.

Allied Colloids, 64 F.3d at 1576, citing Moleculon Research, 793 F.2d at 1265-66.

The essence of "public use" is the free and unrestricted giving over of an invention to a member of the public or the public in general. *Moleculon Research,* 597 F.Supp. at 1427. There is no public use where the invention is revealed to others in a circumstance in which the inventor has a "legitimate expectation of privacy and confidentiality." *See Moleculon Research,* 594 F.Supp. at 1427.

The evidence has not established that the smoker research study was a prior public use under 35 U.S.C. s. 102(b). The factors delineated in *Allied Colloids* strongly favor this court's conclusion.

1. There was an oral obligation of confidentiality imposed upon the participants in the study. There was no written agreement binding the participants to preserve the confidentiality of the study. However, the law does not require such an obligation to be in writing where other indicia of confidentiality are apparent.

2. The small number of participants were carefully screened before acceptance into the study, and were segregated from the general public. They were carefully observed, and were not permitted to retain any of the smoking materials utilized in the study. The test was of limited duration, lasting only a few days overall.

3. From the inception of Project VISA through the conclusion of the study and Kapular's generation of its report, secrecy was of the utmost importance to B & W and its agent for research purposes, Kapular & Associates, Inc. The prototypes were hand assembled, not mass produced. They were made in a very limited quantity specifically for the study.

4. Both physical and conceptual attributes of the reduced circumference prototypes were studied, and Kapular recorded and complied the data obtained. It produced a detailed report for B & W thereafter.

The Federal Circuit noted in Allied Colloids, 64 F.3d at 1574 and 1575, that "commercial purpose underlies virtually every contact between inventor and potential customer ... When testing an invention entails customer contact, that does not convert an otherwise experimental purpose into a public use."

B & W obtained a license to develop Luke's prototype into a marketable product. In Luke's interest, as his licensee and agent, B & W retained a market research firm to assist in the gathering of data in the development process. Clearly Luke's interest is coextensive with the interest of B & W in ensuring confidentiality in the development process. The circumstances do not evidence a "free and unrestricted giving over of an invention to a member of the public or the public in general." *See Moleculon Research, supra.*

We find that PM has failed to prove prior public use under the facts of this case.

2. Claim interpretation

The patent claims:

(14) A finished cigarette

(15) of commercially acceptable quality

(16) and elegant appearance

(17) in the form of an elongated rod of uniform cross-section throughout its length

(18) capable of sustained smoulder when lit but not being smoked

(19) said elongated rod consisting of a cut tobacco filler

(20) a cigarette paper wrapper circumscribing said cut tobacco

(21) a filter in abutment with one end of said cut tobacco filler

(22) the circumference of said elongated rod being within a range of 10mm to 19 mm

(23) and having a cut tobacco filler packing density within the range of 150 mg per cm^3 to 350 mg per cm^3

(24) yielding a free burn rate of said rod within a range of 25 to 45 mg min^{-1}

(25) the aforesaid cigarette utilizing tobacco at greater efficiency than conventional commercially marketed cigarettes.

In this action, the plaintiff has limited its claims of infringement to include the further limitations of:

(26) A packing density of 200 mg per cm^3 to 300 mg per cm^3

(27) provides in excess of eight puffs.

Claim 1 of the '615 patent is an independent claim. The remaining claims are dependent upon Claim 1. B & W asserts that Claims 4 and 11 of the '615 patent are infringed by the VSSS cigarette.

The meaning of the term "cigarette paper wrapper" is in dispute in this case. "Cigarette paper wrapper" appears in Claims 1, 6, and 7 of the '615 patent.

To ascertain the meaning of claims, we consider three sources: The claims, the specification, and the prosecution history." Unique Concepts, Inc. v. Brown, 939 F.2d 1558, 1561 (Fed.Cir.1991) ... Claims must be read in view of the specification, of which they are a part. Autogiro [Co. of America v. United States, 384 F.2d 391 (Cl.Ct.1967)]

Markman v. Westview Instruments, Inc., 52 F.3d 967, 979 (Fed.Cir.1995).

The caveat is that any special definition given to a word must be clearly defined in the specification.

Intellicall, Inc. v. Phonometrics, Inc., 952 F.2d 1384, 1388, 21 USPQ2d 1383, 1386 (Fed .Cir.1992). The written description part of the specification itself does not delimit the right to exclude. That is the function and purpose of claims.

Markman v. Westview Instruments, Inc., 52 F.3d 967, 980 (Fed.Cir.1995).

To construe claim language, the court should also consider the patent's prosecution history, if it is in evidence. Graham v. John Deere Co., 383 U.S. 1, 33, 96 S.Ct. 684, 701, 15 L.Ed.2d 545, 148 USPQ 459, 473 (1966). This "undisputed public record" of proceedings in the Patent and Trademark Office is of primary significance in understanding the claims. *See* Autogiro, 384 F.2d at 397, 155 USPQ at 702 (the "file wrapper" is "part[ ] of the patent"). The court has broad power to look as a matter of law to the prosecution history of the patent in order to ascertain the true meaning of language used in the patent claims:

Th[e] construction of the patent is confirmed by the avowed understanding of the patentee, expressed by him, or on his half *[sic],* when his application for the original patent was pending ... [W]hen a patent bears on its face a particular construction, inasmuch as the specification and claim are in the words of the patentee, ... such a construction may be confirmed by what the patentee said when he was making his application.

Goodyear Dental Vulcanite Co. v. Davis, 102 U.S. 222, 227 (12 Otto 222), 26 L.Ed. 149 (1880); *see* Singer Mfg. Co., 192 U.S. at 278-85, 24 S.Ct. at 296-99 (construing the claims in light of the prosecution history as a matter of law).

Markman v. Westview Instruments, Inc., 52 F.3d 967, 980 (Fed.Cir.1995).

Where there is an equal choice between a broader and a narrower meaning of a claim, and there is an enabling disclosure that indicates that the applicant is at least entitled to a claim having the narrower meaning, we consider the notice function of the claim to be best served by adopting the narrower meaning.

Athletic Alternatives, Inc. v. Prince Mfg., Inc., 73 F.3d 1573, 1581 (Fed.Cir.1996).

First we look to the words of the claims themselves, both asserted and nonasserted, to define the scope of the patented invention. *See* Bell Communications Research, Inc. v. Vitalink Communications Corp., 55 F.3d 615, 620, 34 USPQ2d 1816, 1819 (Fed.Cir.1995). Although words in a claim are generally given their ordinary and customary meaning, a patentee may choose to be his own lexicographer and use terms in a manner other than their ordinary meaning, as long as the special definition of the term is clearly stated in the patent specification or file history. Hoechst Celanese Corp. v. BP Chemicals, Ltd., 78 F.3d 1575, 1578, 38 USPQ2d 1126, 1129 (Fed.Cir.1996).

Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed .Cir.1996).

In most situations, an analysis of the intrinsic evidence alone will resolve any ambiguity in the disputed claim term. In such circumstances, it is improper to rely on extrinsic evidence. *See* Pall Corp. v. Micron Separations, Inc., 66 F.3d 1211, 1216, 36 USPQ2d 1225, 1228 (Fed.Cir.1995).

Vitronics Corp. v. Conceptronic, Inc., 90 F.3d at 1583.

[E]xtrinsic evidence may be relied on when needed to interpret claims, but only when it does not contradict the intrinsic record consisting of the claims themselves, the specification, and the prosecution history.

Trilogy Communications, Inc. v. Times Fiber Communications, Inc., 109 F.3d 739, 744 (Fed.Cir.1997). *See also,* Intellicall, Inc. v. Phonometrics, Inc., 952 F.2d 1384, 1387 (Fed.Cir.1992) ("The terms of a claim are given their ordinary meaning to one skilled in the art unless it appears from the patent and file history that the terms were used differently by the inventors.")

The prosecution history limits the interpretation of claim terms so as to exclude any interpretation that was disclaimed during prosecution. ZMI Corp. v. Cardiac Resuscitator Corp., 844 F.2d 1576, 1580, 6 USPQ2d 1557, 1561 (Fed.Cir.1988).

Southwall Technologies, Inc. v. Cardinal IG Co., 54 F.3d 1570, 1576 (Fed.Cir.1995).

In determining the proper construction of a claim, "the court should look first to the intrinsic evidence of record, *i.e.,* the patent itself, including the claims, the specification, and if in evidence, the prosecution history." Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582, 39 USPQ2d 1573, 1576 (Fed.Cir.1996). We have described such intrinsic evidence as "the most significant source of the legally operative meaning of claim language." *Id.*

CVI/Beta Ventures, Inc. v. Tura LP, 112 F.3d 1146, 1152 (Fed.Cir.1997).

Claim 1 recites as an element of the finished cigarette a cigarette paper wrapper. The parties are in disagreement with respect to the meaning of "cigarette paper wrapper" as that term is used in the '615 patent. Under the doctrine of claim differentiation, where some claims are broad and other narrow, the narrow claim limitations cannot be read into the broad whether to avoid invalidity or to escape infringement. DMI, Inc. v. Deere & Co., 755 F.2d 1570, 1574 (Fed.Cir.1985) (quoting Deere & Co. v. International Harvester Co., 658 F.2d 1137, 1141 (7th Cir.), *cert. denied,* 454 U.S. 969, 102 S.Ct. 514, 70 L.Ed.2d 386 (1981)).

The specification suggests that a finished cigarette manufactured according to the patent will smoulder reliably without additional steps to control the burn process. This is consistent with Claim 7 which limits a cigarette paper wrapper to one possessing conventional air permeability and burn promoting additives. "[T]he specification is always highly relevant to the claim construction analysis." Vitronics Corp., 90 F.3d at 1582.

Claim 1 recites a "cigarette paper wrapper," without establishing any particular design parameters. Claim 7 is limited to a cigarette paper wrapper which possesses the design parameters of (1) a conventional air permeability value and (2) a conventional level of burn promoting additives. In accordance with claim differentiation principles, Claim 7's limitation to certain conventional parameters cannot be read into Claim 1. In other words, the cigarette paper wrapper of Claim 1 is not limited to a cigarette paper wrapper which possesses a conventional air permeability value and utilizes a conventional level of burn promoting additives.

The term "cigarette paper wrapper" must be given its common ordinary meaning to one skilled in the art, unless the term was defined otherwise by Luke. In defining the term, the court must first look to the claim language and specification, with guidance from the file wrapper. Only if the meaning of the term is not

found in these documents can the court look elsewhere for the term's meaning.

PM suggests that the common and ordinary meaning of "cigarette paper wrapper" to one skilled in the cigarette paper wrapper art would be, essentially, a paper used for making cigarettes which possesses a composition, air permeability value, basis weight, and level of additives found in papers manufactured at the time of Luke's invention. These particular design parameters were proven at trial through evidence garnered from its own investigation. This evidence was not gleaned from the patent and file wrapper.

PM argues that a "cigarette paper wrapper" in the '615 patent must be limited to papers possessing these design parameters because Luke used the term "conventional" in describing the cigarette paper wrapper element in his reissue application. PM equates "conventional" with "currently being manufactured." As noted earlier, however, Luke may be his own lexicographer and define the terms utilized in defining his invention Therefore, we can limit "cigarette paper wrapper" in Claim 1 to those cigarette paper wrappers which possess certain industry standard characteristics of composition, permeability, additives, and basis weight only if the term "conventional," as found in the file wrapper, did not portend a different meaning.

The term "paper wrapper" appeared in the original '410 patent. In the reissue application, Luke brought to light an error in distinguishing his invention over the patent to Lephardt, and sought a reissue of the '410 patent, changing the paper wrapper element to a "cigarette paper wrapper," and claiming as a whole, a finished cigarette as defined in Claim 1.

In the reissue application Luke claimed a "cigarette paper wrapper." He explained the distinction between what had previously been claimed and the proposed reissue claims: "... my 4,637,410 patent claims only broadly recite a 'paper wrapper,' whereas in fact my invention is for a finished cigarette ... which ... requires only a conventional cigarette paper wrapper ..." Reissue Application at p. 21. Luke then distinguished his "cigarette paper wrapper" from the corrugated paper wrapper recited by Lephardt. Luke used the term "cigarette paper wrapper" as a term coextensive with "conventional cigarette wrapper" specifically as Lephardt used that terminology. In fact, Luke quoted from the Lephardt patent in that regard:

By contrast, Lephardt discloses a cigarette which includes as an element, a thick corrugated paper wrapper which is excluded by my amended claims ... [T]he Lephardt patent disclosure is directed to a cigarette whose structural rigidity is *not* dependent upon the density of the tobacco packed into the cigarette:

[T]he conventional cigarette wrapper has little structural strength and serves mainly to contain the rod of tobacco. Thus, the cigarette rod owes its structural strength almost entirely to the density of the tobacco in the rod ... The corrugated wrapper, when incorporated in a cigarette, provides a cigarette in which firmness and rigidity can be made independent of the density of the smoking material. (Patent 4,553,556, col. 1, lines 24-31, 37-39, and 47-50).

'615 Reissue Application at p. 21.

In evaluating Luke's use of the term "conventional" with respect to his "cigarette paper wrapper," we must look to the context in which the term appears to find Luke's meaning for the term.

The term "conventional" was used by Lephardt to distinguish his invention over the prior art with which he was faced at the time of his application. He defined the conventional cigarette paper wrapper as "a very thin paper wrapper of little structural strength which contains the rod of tobacco." Luke, in turn, defined

"cigarette paper wrapper" as Lephardt did, to distinguish his element over the corrugated paper wrapper of Lephardt's invention.

The only characteristic addressed by either Lephardt or Luke with respect to conventionality is the structural strength of the paper used in forming a cigarette rod. The strength or structural rigidity of the rod formed with the Lephardt corrugated paper wrapper is relatively independent of the density of the tobacco. This characteristic-structural rigidity-was the principal distinguishing feature of Lephardt.

Claims 1, 4, and 11 of the Luke '615 patent do not contain the word "conventional" to qualify the term "cigarette paper wrapper." However, a limitation with respect to structural strength of the cigarette paper wrapper must be included in our interpretation of the term "cigarette paper wrapper," as the prosecution history contains this limitation. Luke identified the structural strength characteristic of his cigarette paper wrapper in distinguishing his invention over Lephardt, limiting the cigarette paper wrapper element to a very thin paper wrapper possessing little structural strength. We must so limit the term in our construction of Claim 1.

Barbro Goodman surveyed cigarette papers in an attempt to define "conventional" papers for the court. Her survey of the papers on the market between 1985 and 1988 illustrate the differences between what was typically used by cigarette manufacturers and what PM used in its VSSS. The distinctive features of the extra-heavy and two-ply papers in fact rendered them patentable for use in reducing visible sidestream smoke in cigarettes. However, these papers are still "cigarette paper wrappers," as that term was defined by Luke.

Additionally, the fact that Goodman found that many manufacturers used similar cigarette papers, and she therefore deemed them to be a class of "conventional wrappers" is of no moment. We cannot utilize Goodman's definition, which constitutes extrinsic evidence, where we find the definition clearly stated within the patent itself, its specification, and the file wrapper.

Luke's "cigarette paper wrapper" does not include papers which provide a cigarette with firmness and rigidity independent of the density of the smoking material. No other conventional design parameters such as composition, basis weight, air permeability, or additives may be read into Claim 1, however.

3. Obviousness analysis

In determining whether the invention as a whole would have been obvious under 35 U.S.C. s. 103, we must first delineate the invention as a whole. In delineating the invention as a whole, we look not only to the subject matter which is literally recited in the claim in question ... but also to those properties of the subject matter which are inherent in the subject matter *and* are disclosed in the specification. In re Davies, 475 F.2d 667, 177 USPQ 381 (CCPA 1973).... [I]t is the invention *as a whole,* and not some part of it, which must be obvious under 35 U.S.C. s. 103.
In re Antonie, 559 F.2d 618, 169 (C.C.P.A.1977).
In Interconnect Planning corp. v. Feil [774 F.2d 1132, 1139, 227 USPQ 543, 548 (Fed.Cir.1985)], this court stated that an examiner's decision on an original or reissue application is "evidence the court must consider in determining whether the party asserting invalidity has met its statutory burden by clear and convincing evidence," and that, upon reissue, the burden of proving invalidity was "made heavier.

Custom Accessories, Inc. v. Jeffrey-Allan Industries, Inc., 807 F.2d 955, 961 (Fed.Cir.1986).

With reference to one skilled in the art, the United States Court of Appeals for the Federal Circuit stated in Standard Oil Co. v. American Cyanamid Co., 774 F.2d 448, 454 (Fed.Cir.1985):

The issue of obviousness is determined entirely with reference to a *hypothetical* "person having ordinary skill in the art." It is only that hypothetical person who is presumed to be aware of all the pertinent prior art. The actual inventor's skill is irrelevant to the inquiry and this is for a very important reason. The statutory emphasis is on a person of *ordinary* skill. Inventors, as a class, according to the concepts underlying the Constitution and the statutes that have created the patent system, possess something-call it what you will-which sets them apart from the workers of *ordinary* skill, and one should not go about determining obviousness under s. 103 by inquiring into what *patentees* (*i.e.* inventors) would have known or would likely have done, faced with the revelations of references. A person of ordinary skill in the art is also presumed to be one who thinks along the line of conventional wisdom in the art and is not one who undertakes to innovate whether by patient, and often expensive, systematic research or by extraordinary insights, it makes no difference which.

In Custom Accessories, Inc, 807 F.2d at 962-63, the Federal Circuit further discussed the skill of the hypothetical person:

Factors that may be considered in determining level of skill include: type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field. Not all such factors may be present in every case, and one or more of them may predominate.

The relevant art for determining the obviousness of the '615 patent is the art of cigarette design. A person of ordinary skill in the art of cigarette design would have held a bachelor's degree in engineering, chemistry, physics, or chemical engineering, and would have worked for a minimum of five years in the field of cigarette design. There were, to be sure, experienced and knowledgeable persons in the field at the relevant time who possessed a different composite of credentials; greater or lesser education balanced with varied levels of experience. However, for purposes of our analysis, our hypothetical one skilled in the art would possess no less than the five years in design and the bachelor's degree qualifications we have identified.

In evaluating whether the invention in question was obvious in light of the prior art, the court must focus on the claims of the '615 patent which establish the metes and bounds of the invention, not on the Capri cigarette which is merely a particular embodiment of the patented invention. *See* Jackson Jordan, Inc. v. Plasser American Corp., 747 F.2d 1567, 1578 (Fed.Cir.1984), citing Graham v. John Deere Co., 383 U.S. 1, 17, 86 S.Ct. 684, 693, 15 L.Ed.2d 545 (1966), and Perkin-Elmer Corp. v. Computervision Corp., 732 F.2d 888, 902 (Fed.Cir.1984).

The court must also keep in mind that "obviousness does not require absolute predictability of success." In re O'Farrell, 853 F.2d 894, 903 (Fed.Cir.1988). The court reasoned:

[F]or many inventions that seem quite obvious, there is no absolute predictability of success until the invention is reduced to practice. There is always at least a possibility of unexpected results, that would then provide an objective basis for showing that the invention, although apparently obvious, was in law nonobvious.

In re O'Farrell, 853 F.2d at 903, citing In re Merck & Co., Inc., 800 F.2d 1091 (Fed.Cir.1986).

When obviousness is based upon a modification of a particular prior art reference, there must be a showing of a suggestion or motivation to modify the teachings of that reference. See Kolmes v. World Fibers Corp., 107 F.3d 1534, 1541 (Fed.Cir.1997). The "obviousness" inquiry under s. 103 requires that the claimed invention be viewed as a whole. Interconnect Planning Corp. v. Feil, 774 F.2d at 1139. First, for a finding of obviousness, the prior art must suggest to one skilled in the art that scaling down a standard cigarette to a reduced circumference of 10 to 19 mm was plausible.

In Motorola, Inc. v. Interdigital Technology Corp., 121 F.3d 1461, 1472 (Fed.Cir.1997), the Federal Circuit reaffirmed that there must be some suggestion for combining prior art references, but noted that "there is no requirement that the prior art contain an express suggestion to combine known elements to achieve the claimed invention. Rather, the suggestion to combine may come *from* the prior art, as filtered through the knowledge of one skilled in the art."

The parties agree that the person of ordinary skill in the art of cigarette design would be familiar with reducing the circumference of an orthodox (25 mm) cigarette to a circumference as small as 21 mm and that a 21 mm cigarette, such as the More, could be manufactured within commercially acceptable parameters.

The narrower question before the court is whether a further reduction from the orthodox circumference to the range of 10 to 19 mm, with the parameters specified in Claims 1, 4, and 11 of the '615 patent would have been obvious to one skilled in the art.

In the case of In re Huang, 100 F.3d 135, 139-40 (Fed.Cir.1996), the United States Court of Appeals for the Federal Circuit noted:

This court and its predecessors have long held, however, that even though applicant's modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within the capabilities of one skilled in the art, unless the claimed ranges "produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art." [citations omitted] ... Once a *prima facie* case of obviousness has been established, the burden shifts to the applicant to come forward with evidence of nonobviousness to overcome the *prima facie* case. Relevant to his inquiry is objective evidence of commercial success, long-felt but unsolved needs, failure of others, and copying. *Graham,* 383 U.S. at 17-18, 86 S.Ct. at 693,94, 148 USPQ at 467 ... Even assuming that Huang had sufficiently demonstrated commercial success, that success is relevant in the obviousness context only if there is proof that the sales were a direct result of the unique characteristics of the claimed invention-as opposed to other economic and commercial factors unrelated to the quality of the patented subject matter. *See* Cable Elec., 770 F.2d at 1027, 226 USPQ at 888. In other words, a nexus is required between the sales and the merits of the claimed invention ... [T]he applicant must submit some factual evidence that demonstrates the nexus between the sales and the claim invention-for example, an affidavit from the purchaser explaining that the product was purchased due to the claimed features. In the present case, despite Huang's personal opinion, Wilson may have bought the grips due to lower manufacturing costs, the market position of Huang's company, prior relations between the two companies, or features of the product attractive to Wilson but unrelated to the patented subject matter. In sum, Huang simply has not carried his burden to prove that a nexus existed between any commercial success and the novel features claimed in the application.

In In re Woodruff, 919 F.2d 1575 (Fed.Cir.1990), it is stated:

It is the general rule that merely discovering and claiming a new benefit of an *old* process cannot render the process again patentable ... [T]he applicant must show that the particular range is *critical,* generally by showing that the claimed range achieves unexpected results relative to the prior art range. [citations omitted].

In the case of In re Waymouth, 499 F.2d 1273, 1276 (C.C.P.A.1974), the court discussed whether a critical range in an invention claimed to achieve an optimum result was obvious:

We cannot agree with the board that appellants' claimed ratio was the result of obvious experimentation, since, in our judgment, any such experimentation would not have come from *within the teachings of the art*. In re Fay, 347 F.2d 597, 52 CCPA 1483 (1965). In determining whether or not such experimentation is within the teachings of the art, we "must be ever alert not to read obviousness into an invention on the basis of the [inventors'] own statements; that is we must view the prior art without reading into that art [the inventors'] teachings ... In order to show an unexpected result, we do not believe that the lamp must be inoperable over other ranges, but rather that over the claimed critical range, there be a difference in kind rather than in degree. *In re Shepard, supra*. We believe that Figure 2 demonstrates such a marked improvement, over the results achieved under other ratios, as to be classified as a difference in kind, rather than one of degree.

The facts before this court, however, establish that the static burn rate and improved TUE of a 10 to 19 mm cigarette over the orthodox cigarette was predicted by the prior art and did not achieve such a marked improvement as would classify the cigarette of the '615 patent as achieving a difference in kind rather than one of degree over the other reduced circumference cigarettes on the market at the time of Luke's invention. *See also,* Powers-Kennedy Contracting Corp. v. Concrete Mixing & Conveying Co., 282 U.S. 175, 51 S.Ct. 95, 75 L.Ed. 278 (1930) (concerning change in size of pipes for transportation of concrete, the Supreme Court stated, "But obviously a mere change in proportion would involve no more than mechanical skill and would not amount to invention.")

The sum total of this patent is that a commercially acceptable cigarette could be made within the specified design parameters. The purported invention in creating such a cigarette was Luke's discovery that his 10 to 19 mm cigarette utilized tobacco at a more efficient rate than conventional cigarettes and afforded certain other advantages which he claims were heretofore unknown to those skilled in the art. The question of obviousness as applied to this patent is whether the prior art suggested to one skilled in the art that such a cigarette be made and how it could be achieved. The concept of TUE is critical to this analysis inasmuch as the discovery of the increased efficiency was Luke's key to solving his expressed long-felt need to reduce the amount of tobacco used in a cigarette. Thus, the burning of tobacco more efficiently in a reduced circumference cigarette permitted a commercially adequate puff count and sustained smoulder in a 10 to 19 mm circumference cigarette.

The question remains whether there were any harbingers of Luke's science. This court believes that there were. We find that one skilled in the art of cigarette design armed with the prior art would know that a 10% reduction in circumference of the thinnest cigarette then on the market would yield a cigarette which burns tobacco more efficiently, as TUE is defined by Luke. Resnick specifically identified the phenomenon.

It is not Resnick alone which rendered Luke's cigarette obvious. Rather, it is a combination of prior art references that causes us to conclude that Luke's cigarette was obvious to one skilled in the art.

Rice taught the linear relationship of circumference to static burn rate, down to a circumference of 23 mm. Muramatsu suggested that the relationship existed, in theory, to 18.8 mm. In fact, cigarettes which sold successfully on the American market had circumferences as small as 20.7 and 20.8 mm at the time of Luke's discovery. These cigarettes with smaller circumferences included the More, Phoenix, Suede, L.T. Brown, Dawn, and Eve. Resnick provided the motivation in his 1977 publication to reduce circumference and thereby better utilize tobacco by teaching that, all other parameters being kept constant, a reduction in circumference resulted in a greater percentage reduction in tobacco weight than percentage reduction in puff count. That is, that as circumference is decreased, TUE improves. Additionally, the machine technology existed at the time of Luke's discovery and was advertized as available by the Molins Machine Company, one of the major cigarette manufacturing machine companies then in existence.

B & W points to secondary considerations in support of its contention that the cigarette of the '615 patent would not have been obvious to one skilled in the art. Objective evidence of commercial success, long-felt but unresolved need, unexpected results, skepticism, praise and copying must be considered by the court in the obviousness analysis. Secondary considerations are concerned with "how the patented device is viewed by the interested public: not the inventor, but persons concerned with the product in the objective arena of the marketplace." Arkie Lures, 119 F.3d at 957.

"Commercial success" has been defined as a "substantial share of a definable market." In re Huang, 100 F.3d at 140.

Capri achieved approximately a 0.5% market share when Capri was introduced. This was only half of B & W's total goal of a 1% share in the United States. Unlike other cases where products have "taken the market by storm," or revolutionized an industry, we do not find such an advance in the art here. Capri subdivided the female market by creating what has become known as the subclass of ultraslim cigarettes. It is interesting that the Capri's feminine imagery has fostered a certain female following, an astute evaluation by B & W of the course of the female market. We cannot conclude from the evidence before us, however, that the 0.5% market share achieved by Capri evidences that it was a nonobvious cigarette design. B & W itself has suggested that Capri's female following in the marketplace came in some part from Virginia Slims smokers, a group already devoted to slimmer cigarette brands. We are not convinced that this move to Capri is more than an additional step in the slim market.

[W]here the success of an invention is due to advertising, good business sense, the prior art, etc. rather than the advantages inherent in the discovery, it is irrelevant to a determination of obviousness. See In re Sneed, 710 F.2d 1544, 1551 (Fed.Cir.1983) [and others].

Revlon, Inc. v. Carson Products Co., 602 F.Supp. 1071 (S.D.N.Y.1985). In the *Revlon* case, the court found that the commercial success of "Dark & Lovely," a hair straightening chemical product, was not shown to have a nexus to the patented product attributes. Rather, the court found that the highly successful sales were the result of appropriately targeted marketing to the African American female population through product name, packaging, and advertising.

Similarly, the heavy promotional efforts made on behalf of Capri, such as free cartons and large coupon offers, which fostered, in part, Capri's 0.5% share, weakens B & W's assertion that Capri was a recognized and fervently embraced development in the cigarette art. Additionally, it is impossible, based upon the evidence before us, for this court to distinguish market share resulting from the patented attributes of the

Capri cigarette, from that which was achieved through targeted marketing and image development promoted by B & W for the brand. Thus, B & W has not established commercial success linked to Capri's patented attributes which would bolster its assertion that the cigarette of the '615 patent was nonobvious.

B & W contends that there was a long-felt but unresolved need in the tobacco industry to find a way to use less tobacco in cigarettes. Luke stated that the increased tobacco utilization efficiency ("TUE") which he articulated in his patent constituted a breakthrough in solving this long-felt need. This long-felt need is premised on the basic desire to maximize profit-using less tobacco per cigarette translates into greater profits for the manufacturer. The objective of maximum profit was also addressed by solutions such as using cheaper grades of tobacco, incorporating expanded tobacco, using corrugated wrappers if a commercially acceptable product could be achieved, or increasing sales volume. Even if the court accepted the proposition that the need existed to maximize profit through the specific means using less tobacco, that need had been previously addressed albeit with different solutions. The innovation of expanded tobacco, for example, was one invention which was already in existence at the time Luke was addressing the problem.

Further, B & W has not established that others tried and failed to make an ultra-thin cigarette. There is no evidence that there was a perceived interest among consumers for such a product. B & W's business acumen in marketing a feminine-image product does not translate, in this instance, into satisfaction of a long-felt but unresolved need in the industry.

Finally, it is important not to lose sight of the contours of the discovery which is claimed by Luke. There is no element in the claims in issue relating to tobacco weight in a cigarette.FN4 In fact, Luke acknowledges the fact that the amount of tobacco contained in a cigarette according to his invention may vary depending upon the length of the cigarette. While a cigarette of 25% less weight may be made, it is not an element of the claims in issue, nor is it at the epicenter of this patent. It is the increased efficiency with which the tobacco burns in a cigarette of reduced circumference which was Luke's discovery. As noted in Indian Head Industries, Inc. v. Ted Smith Equipment Co., Inc., 859 F.Supp. 1095, 1107 (E.D.Mich.1994), "[s]tating a problem broadly enough, almost any step forward can be said to address a long-felt need."

FN4. Claim 10 includes the limitation that the cigarette contain on the order of 25% less tobacco, and yet provide an equal or greater number of puffs, than conventional, commercially marketed cigarettes. Claim 10, and Claims 12, 14-16 which contain similar limitations, are not in issue.

B & W contends that the Debardeleben article teaches away from the Luke cigarette. Debardeleben stated that puff count decreases by 19% for every 15% reduction in circumference. B & W contends that based upon this statement a person of ordinary skill in the art would have concluded that a cigarette with a circumference of 10-19 mm would not produce an acceptable number of puffs. This court concludes that Debardeleben does not teach away from the Luke cigarette. B & W also contends that the patents to Lephardt and Strydom teach away from the Luke cigarette. We do not agree. Lephardt has been distinguished as a different method-utilization of a corrugated wrapper-to reduce cigarette circumference. We have determined that Strydom is not prior art, since the 1985 and 1987 applications were abandoned and cannot be relied upon to establish constructive reduction to practice prior to or contemporaneously with Luke's discovery. *See,* i.e., Fessenden v. Wilson, 48 F.2d 110 (CCPA 1934).

One skilled in the art would be familiar with Rice and Resnick at the time the Debardeleben article was published, so the linear relationship between circumference and static burn rate and the improvement in the

utilization of tobacco at smaller circumferences was already known. The percentage comparison made by Debardeleben between the reduction in circumference and the reduction in puff count does not provide discouraging information to the cigarette designer. The comparison is, in fact, of little use.

As we have stated, cigarettes were being successfully developed and sold with circumferences below the orthodox 25 mm, having been reduced to 23 mm and to 20.8 mm. Thus, one of ordinary skill in the art would, if motivated to do so, attempt to discern how much further circumference could be reduced while still producing a commercially acceptable cigarette. Debardeleben is not of assistance in finding the answer to this question, as the 19%-15% comparison only offers insight into percentage reductions for comparative purposes. The formula which is essential to the research is the Rice formula which allows the researcher to predict static burn rates at reduced circumferences, Muramatsu suggesting that the linear relationship may hold true at circumferences within the 10 to 19 mm range (as small as 18.8 mm). Resnick made clear that the percentage decrease in puff count is not as great as the percentage weight reduction as circumference is reduced. Puff count to weight reduction (*i.e.,* TUE) is the critical comparison for the researcher in determining the amount by which the circumference of a cigarette could be further reduced successfully below the orthodox 25 mm.

In sum, we conclude that B & W has failed to establish that a long-felt need existed; but even if it did, we conclude that it was not a need which went unresolved until Luke's discovery.

The Capri cigarette was praised by PM, as is evidenced by its internal documents introduced at trial. There was no evidence offered regarding praise for the product from other tobacco companies. There is no question that Capri was a new and different product in the cigarette marketplace. PM described the product as "unique," "radically novel," "atypical in the market," and "astonishing" in size which clearly constitutes praise for what they saw. However, these statements culled from PM documents do not discuss whether the creation of the Capri constitutes innovative science. We cannot infer from these remarks more than that PM viewed the product as a unique and innovative newcomer to the market.

B & W points to the statement in a PM document that "we cannot make such a product at present for lack of appropriate equipment" as somehow praising the science as new and radical. We do not believe that such inference is warranted in light of the fact that the statement refers to equipment availability only. *Compare* Akzo NV v. U.S. International Trade Commission, 808 F.2d 1471, 1481 (Fed.Cir.1986), *cert. denied,* 482 U.S. 909 (1987) (praise found in internal *scientific* report which specifically delineated the perceived PPD-T degradation problem and the amazing result of the patented process).

B. INFRINGEMENT

Title 35, United States Code, Section 271(a) provides: "[W]hoever without authority makes, uses or sells any patented invention within the United States during the term of the patent therefor, infringes the patent."

[D]irect infringement requires a two-step analysis. The claimed invention must first be defined, a legal question of claim interpretation. Second, the trier of fact must determine whether the claims, as properly interpreted, cover the accused devise or process. The second step involves a question of fact. [citations omitted]. The burden is on ... the patent owner, to prove infringement by a preponderance of the evidence. *See, e.g.* Uniroyal, Inc., 837 F.2d at 1054, 5 U.S.P.Q.2d at 1441. Such proof must show that every limitation of the patent claims asserted to be infringed is found in the accused device, either literally or by an equivalent. *See* Pennwalt v. Durand-Wayland, Inc., 833 F.2d 931, 935, 4 U.S.P.Q.2d 1737, 1739-40

(Fed.Circ.1987) (in banc *[sic]*), *cert. denied,* 485 U.S. 961, 108 S.Ct. 1226, 99 L.Ed.2d 426 (1988), 485 U.S. 1009, 108 S.Ct. 1474, 99 L.Ed.2d 703 (1988).

Smithkline Diagnostics v. Helena Laboratories Corp., 859 F.2d 878, 889 (Fed.Cir.1988).

In determining whether Claims 4 and 11 of the '615 patent read on the Virginia Slims Superslims cigarette, we need only address the "cigarette paper wrapper" element. This is the only element the presence of which is in dispute. Having determined the meaning and scope of "cigarette paper wrapper," as that term is used in the '615 patent, we conclude that there is literal infringement and, alternatively, infringement under the doctrine of equivalents.

PM argues that its VSSS cigarette does not infringe because its unique papers provide the added benefit of reducing sidestream smoke. It notes that, in rewriting his Claim 1 of the '615 patent, Luke changed the language of the claim from a cigarette "comprising" certain elements to a finished cigarette "consisting of" certain elements. The case law explains that there is an important distinction between the terms "consisting" and "comprising."

As noted in Parmelee Pharmaceutical Co. v. Zink, 285 F.2d 465, 469 (8th Cir.1961),

The word "comprising" in the patent law is an open-ended word and one of enlargement and not of restriction. Claim 17 includes the expression "loose granules of a natural material of the group comprising wood and grain." The word "comprising" does not exclude other materials besides wood and grains ... In contrast, the word "consisting" is one of restriction and exclusion.

In the case of Dow Chemical Co. v. American Cyanamid Co., '615 F.Supp. 471, 484 (E.D.La.1985), the District Court for the Eastern District of Louisiana attempted to discern the distinction between the terms "comprising" and "consisting essentially of" (a finer distinction than we are required to make here):

The term "comprising" permits the inclusion of other steps, elements or materials in addition to the elements or components specified in the claim. In re Baxter, 656 F.2d 679, 686 (C.C.P.A.1981). The term "consisting essentially of" limits the scope of the claims to the specified ingredients, and those that do not materially affect the basic and novel characteristics of a composition.

In the case before us, the term "consisting" in Claim 1 refers to the particular components of the "said elongated rod," one of which is a cigarette paper wrapper. Thus the claim requires that the elongated rod in question have a cigarette paper wrapper which circumscribes the cut tobacco filler and not something else. If the component which is utilized to form the cut tobacco filler into the geometry of a rod is not a "cigarette paper wrapper," then the alleged infringing device does not infringe the '615 patent. We have determined, however, that the paper utilized by PM in forming its VSSS cigarettes is a "cigarette paper wrapper" as that term was defined by Luke. Thus the improvements or added benefits afforded by the PM papers do not preclude them from satisfying the element of Claim 1 of the patent, despite the change in terminology from "comprising" to "consisting." Lastly, we would add that changes in the chemical composition of the paper or the addition of burn promoters or retardants does not call into question the identity of the paper as a "cigarette paper wrapper."

The VSSS cigarette is comprised of a cigarette paper wrapper, as that term is utilized in the '615 patent, in addition to possessing the other elements which combine to form the finished cigarette of that patent. The

two-ply and extra heavy papers are "very thin paper wrapper[s] of little structural strength which contain the rod of tobacco," despite PM's claim that these papers provide *greater* structural rigidity than others on the market.

Additionally, the features of high basis weight, low porosity, filler with calcium carbonate crystals, and the addition of burn promoters and retardants do not change their basic identity as "cigarette paper wrappers," as the term was defined by Luke. The improvements or benefits offered by PM's particular cigarette paper wrappers do not impact this analysis.

We find that PM's two-ply and extra-heavy papers are "cigarette paper wrappers" utilized in the construction of the finished VSSS cigarette in which every other limitation set out in independent Claim 1, and dependent Claims 4 and 11 are also found. *See,* Southwall Technologies, Inc. v. Cardinal IG Co., 54 F.3d 1570 (Fed .Cir.1995).

PM procured patents on its two-ply and extra-heave paper wrappers. United States Patent Nos. 4,998,543 and 5,450,862 respectively. The fact of the procurement of these patents, while deserving of note, does not alter this court's view. As stated in Atlas Powder Co. v. E.I. DuPont De Nemours & Co., 750 F.2d 1569, 1580 (Fed.Cir.1984),

We agree with Bendix Corp. v. United States, 199 USPQ 203 (Ct. Cl. Trial Div.1978), *aff'd,* 600 F.2d 1364, 220 Ct. Cl. 507, 204 USPQ 617 (1979). There the trial judge said that where defendant has appropriated the material features of the patent in suit, infringement will be found "even when those features have been supplemented and modified to such an extent that the defendant may be entitled to a patent for the improvement." 199 USPQ at 221-22.

We conclude that the VSSS cigarette literally infringes the '615 patent. Further, we conclude that the VSSS cigarette infringes the '615 patent under the doctrine of equivalents.

Infringement under the doctrine of equivalents is an equitable doctrine devised for "situations where there is no literal infringement but [where] liability is nevertheless appropriate to prevent what is in essence a pirating of the patentee's invention." Loctite Corp. v. Ultraseal Ltd., 781 F.2d 861, 870, 228 USPQ 90, 96 (Fed.Cir.1985).

Insta-Form Products, Inc. v. Universal-Foam Systems, Inc., 906 F.2d 698, 702 (Fed.Cir.1990).

Assuming, *arguendo,* that we had concluded that there was no literal infringement of Claim 1, we would proceed to determine whether the VSSS cigarette contains elements identical or equivalent to each claimed element of the '615 patent. Again, it has been conceded by PM that its product contains all elements of Luke's claimed invention except the cigarette paper wrapper element.

In Warner-Jenkinson Co., Inc. v. Hilton Davis Chemical Co. 520 U.S. 17, 117 S.Ct. 1040, 1052-53, 137 L.Ed.2d 146 (1997), the United States Supreme Court quoted from Union Paper Bag Machine Co. v. Murphy, 97 U.S. 120, 125, (7 Otto 120), 24 L.Ed. 935 (1877):

The substantial equivalent of a thing, in the sense of the patent law, is the same as the thing itself; so that if two devices do the same work in substantially the same way, and accomplish substantially the same result, they are the same, even though they differ in name, form, or shape ... [I]n determining the question of

infringement, the court or jury, as the case may be, ... are to look at the machines or their several devices or elements in the light of what they do, or what office or function they perform, and how they perform it, and to find that one thing is substantially the same as another, if it performs substantially the same function in substantially the same way to obtain the same result.

The court went on to discuss the way in which equivalence is to be determined:

All that remains is to address the debate regarding the linguistic framework under which "equivalence" is determined. Both the parties and the Federal Circuit spend considerable time arguing whether the so-called "triple identity" test-focusing on the *function* served by a particular claim element, the *way* that element serves that function, and the *result* thus obtained by that element-is a suitable method for determining equivalence, or whether an "insubstantial differences" approach is better.... In our view, the particular linguistic framework used is less important than whether the test is probative of *the essential inquiry: Does the accused product or process contain elements identical or equivalent to each claimed element of the patented invention?* Different linguistic frameworks may be more suitable to different cases, depending on their particular facts. A focus on individual elements and a special vigilance against allowing the concept of equivalence to eliminate completely any such elements should reduce considerably the imprecision of whatever language is used. *An analysis of the role played by each element in the context of the specific patent claim will thus inform the inquiry as to whether a substitute element matches the function, way, and result of the claimed element, or whether the substitute element plays a role substantially different from the claimed element*. With these limiting principles as a backdrop, we see no purpose in going further and micro-managing the Federal Circuit's particular word-choice for analyzing equivalence. We expect that the Federal Circuit will refine the formulation of the test for equivalence in the orderly course of case-by-case determinations, and we leave such refinement to that court's sound judgment in this area of its special expertise.

Warner-Jenkinson Co., 117 S.Ct. at 1054 (emphasis added).

PM suggests that the doctrine of prosecution history estoppel should be applied to "preclude B & W from relying upon the doctrine of equivalents *at all* " in this action. (Post trial brief at p. 89). PM asserts, in essence, that a patent holder cannot reclaim through application of the doctrine of equivalents that which was specifically surrendered to avoid the prior art and obtain the patent. This is a correct statement of the legal principle; however, it is inapplicable here.

In Southwall Technologies, Inc. v. Cardinal IG Company, 54 F.3d 1570, 1578 (Fed.Cir.1995), the United States Court of Appeals for the Federal Circuit discussed the doctrine of prosecution history estoppel and its application:

Southwall seems to imply that principles of prosecution history estoppel are relevant in the claim construction step of a determination of literal infringement. There is, however, a clear distinction between following the statements in the prosecution history in defining a claim term, and the doctrine of prosecution history estoppel, which limits expansion of the protection under the doctrine of equivalents when a claim has been distinguished over relevant prior art. Biodex Corp. v. Loredan Biomedical, Inc. 946 F.2d 850, 862, 20 USPQ2d 1252, 1262 (Fed.Cir.1991), *cert. denied,* 504 U.S. 980, 112 S.Ct. 2957, 119 L.Ed.2d 579 (1992). Claim interpretation in view of the prosecution history is a preliminary step in determining literal infringement, while prosecution history estoppel applies as a limitation on the range of equivalents if, after the claims have been properly interpreted, no literal infringement has been found. *See* Senmed, Inc., 888

F.2d at 818-21, 12 USPQ2d at 1511-13. The limit on the range of equivalents that may be accorded a claim due to prosecution history estoppel is simply irrelevant to the interpretation of those claims.

Southwall Technologies makes clear that prior claim interpretation requires reference to the prosecution history and appropriate application of any contours to the claims which are created by this record before the PTO. In this case, we have concluded that Luke defined his "cigarette paper wrapper," as Lephardt did, to include paper wrappers "having little structural strength and serving mainly to contain the rod of tobacco ...," and excluding Lephardt's corrugated paper wrapper which provided structural rigidity to the tobacco rod relatively independent of the density of the tobacco.

The doctrine of prosecution history estoppel would not preclude B & W from relying upon the doctrine of equivalents, as PM suggests, but rather would prohibit B & W from going beyond Luke's definition of cigarette paper wrapper in applying the doctrine of equivalents. Only cigarettes utilizing paper wrappers of little structural strength which serve mainly to contain the rod of tobacco may come under the purview of the '615 patent. Cigarettes excluded from this category, a category which was specifically contoured by Luke in the prosecution of the patent, cannot be equivalent, no matter how similar in other respects.

We conclude that the two-ply and extra-heavy papers meet the criterion of Luke's cigarette paper wrapper element despite their higher basis weight and other attributes.

The Supreme Court established in Warner-Jenkinson, 117 S.Ct. at 1049 that "the doctrine of equivalents must be applied to individual elements of the claim, not to the invention as a whole." PM has directed this court to "focus solely on the uniqueness of the Superslims' wrappers" in our equivalents analysis. (PM's Post-Trial Brief at p. 87).

The Superslims' wrappers perform different *additional* functions by reducing sidestream smoke. PM suggests that because the composition of the papers differs from other papers and thus the "way" in which the papers achieve the benefit of reducing the sidestream smoke is substantially changed from the cigarette paper wrappers with which Luke was concerned. PM contends that the "function" and the "result" parts of the three-part doctrine of equivalents test cannot be satisfied because of these unique features of their papers.

It is the limitations and functions of the invention described in the claims, not the elements or functions of the accused device, which establish the reference point for the doctrine of equivalents analysis. *See generally* Pennwalt Corp. v. Durand-Wayland Inc., 833 F.2d 931, 4 USPQ2d 1737 (Fed.Cir.1987) (*in banc*). Thus, infringement under the doctrine of equivalents is not precluded merely because the accused device performs functions in addition to those performed by the claimed device.... *See* Uniroyal, Inc. v.. Rudkin-Wiley Corp., 837 F.2d 1044, 1057, 5 USPQ2d 1434, 1444 (Fed .Cir.1988) ("Adding features to an accused device will not result in noninfringement if all the limitations in the claims, or equivalents thereof, are present in the accused device.").

Insta-Foam Products, Inc., 906 F.2d at 702.

The benefit of reduced sidestream smoke achieved with these cigarette paper wrappers is in addition to and does not alter its main purpose to contain the rod of tobacco.

The attributes of PM's papers do not substantially affect their identity as cigarette paper wrappers for

purposes of this analysis.

The PM patented wrappers provide *greater* structural rigidity than a thinner paper. However, the Superslims' wrappers have not been shown to fall outside of the definition of a "very thin wrapper of little structural strength which contains the rod of tobacco," such that the marginal difference in rigidity due to the weight of the paper would render the Superslims' papers substantially different from, and thus not equivalent to the "cigarette paper wrapper" claimed in the '615 patent.

The two-ply and extra-heavy wrappers are each wrapped about a cut tobacco filler to form a tobacco rod and sealed with a lap seam. The wrappers perform substantially the same function of containing the tobacco in the form of a rod as the "cigarette paper wrapper" of the '615 patent. This function is performed in substantially the same way as the "cigarette paper wrapper" inasmuch as the two-ply or extra-heavy wrapper is wrapped about a cut tobacco filler and sealed with a lap seam to achieve the resulting tobacco rod. The composition of the two-ply and extra-heavy wrappers does not substantially change the way in which the formation of the tobacco rod is achieved.

PM contends that the Superslims' wrappers control burn rate and tar delivery in a different way from other wrappers because the paper composition and burn additives provide a unique combination of these features. While this may be an articulable distinction, this is an aspect of the low sidestream advantage which was the focus of the PM patents on these papers. This "way" of achieving the low sidestream "result" does not change the basic characteristics of the papers which make them "cigarette paper wrapper" equivalents.

Having found equivalence in the cigarette paper wrapper element, we conclude that the VSSS cigarette infringes Counts 4 and 11 of the '615 patent under the doctrine of equivalents.

C. UNENFORCEABILITY

"Applicants for patents are required to prosecute patent applications in the PTO with candor, good faith, and honesty ... In light of all the circumstances, an equitable judgment must be made concerning whether the applicant's conduct is so culpable that the patent should not be enforced." Molins PLC v. Textron, Inc., 48 F.3d 1172, 1178 (Fed.Cir.1995) (footnote omitted).

Title 37, CODE OF FEDERAL REGULATIONS, Section 1.56(a) and (c) explains the duty of candor owed to the PTO and to whom this duty extends. It states, in pertinent part:

(a) ... Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section ... There is no duty to submit information which is not material to the patentability of any existing claim ...

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1) Each inventor named in the application;

(2) Each attorney or agent who prepares or prosecutes the application; and

(3) Every other person who is substantially involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

The United States Supreme Court explained:

[A] patent is an exception to the general rule against monopolies and to the right to access to a free and open market. The far-reaching social and economic consequences of a patent, therefore, give the public a paramount interest in seeing that patent monopolies spring from backgrounds free from fraud or other inequitable conduct and that such monopolies are kept within their legitimate scope.

Precision Instrument Manufacturing Co. v. Automotive Maintenance Machinery Co., 324 U.S. 806, 816, 65 S.Ct. 993, 998, 89 L.Ed. 1381 (1945).

The Federal Circuit discussed various forms inequitable conduct may take and the burden to establish that such conduct has occurred:

Inequitable conduct includes affirmative misrepresentation of a material fact, failure to disclose material information, or submission of false material information coupled with an intent to deceive. *See* J.P. Stevens & Co. v. Lextex, Ltd., 747 F.2d 1553, 1559, 223 USPQ 1089, 1092 (Fed.Cir.1984), *cert. denied,* 474 U.S. 822, 106 S.Ct. 73, 88 L.Ed.2d 60 (1985). One who alleges inequitable conduct arising from a failure to disclose prior art must offer clear and convincing proof of the materiality of the prior art, knowledge chargeable to the applicant of that prior art of its materiality, and the applicant's failure to disclose the prior art, coupled with an intent to mislead the PTO ... Materiality does not presume intent, which is a separate and essential component of inequitable conduct.

Molins PLC, 48 F.3d at 1178.

PM points out that B & W(1) failed to bring the Resnick article and the More cigarette to the attention of the PTO, and (2) made an erroneous representation regarding the puff count of the Ten Cent cigarette in the reissue application. PM contends that B & W intended to deceive the PTO in these matters, that these are material misrepresentations or omissions, and that this court should therefore hold the '615 patent unenforceable.FN5

FN5. PM suggests that Luke should have submitted Resnick to the PTO after the reissue proceeding closed, citing 37 C.F. R. s. 1.501 and MPEP s. 2003.01. We need not resolve the question of whether the patent office procedures allow for such disclosure after the close of the proceedings, since the position regarding the immateriality of Resnick has remained the same throughout, both before and after the '615 reissue.

"Information is 'material' when there is a substantial likelihood that a reasonable examiner would have considered the information important in deciding whether to allow the application to issue as a patent." Molins PLC, 48 F.3d at 1179. The Federal Circuit then discussed intent to deceive:

"Intent" commonly means: "Design, resolve, or determination with which [a] person acts [; a] state of mind in which a person seeks to accomplish a given result through a course of action." *Black's Law Dictionary* at 810 (6th ed.1990). Intent need not be proven by direct evidence; it is most often proven by a showing of

acts, the natural consequences of which are presumably intended by the actor. Kansas Jack, Inc. v. Kuhn, 719 F.2d 1144, 1151, 219 USPQ 857, 861 (Fed.Cir.1983). Generally, intent must be inferred from the facts and circumstances surrounding the applicant's conduct ... However, "[g]iven the ease with which a relatively routine act of patent prosecution can be portrayed as intended to mislead or deceive, clear and convincing evidence of conduct sufficient to support an inference of culpable intent is required." [citations omitted].

Molins PLC, 48 F.3d at 1180-81.

[A] finding of deceptive intent can not *[sic]* be based on mere inference or even on gross negligence; there must be "conduct, viewed in light of all the evidence, including evidence indicative of good faith, [that] must indicate sufficient culpability to require a finding of intent to deceive." Intent to deceive can not *[sic]* be inferred solely from the fact that information was not disclosed; there must be a factual basis for a finding of deceptive intent. *See* Braun, Inc. v. Dynamics Corp., 975 F.2d 815, 822, 24 USPQ 2d 1121, 1127 (Fed.Cir.1992).

Hebert v. Lisle Corp., 99 F.3d 1109, 1116 (Fed.Cir.1996).

No single factor or combination of factors can be said always to *require* an inference of intent to mislead; yet a patentee facing a high level of materiality and clear proof that it knew or should have known of that materiality, can expect to find it difficult to establish "subjective good faith" sufficient to prevent the drawing of an inference of intent to mislead. A mere denial of intent to mislead (which would defeat every effort to establish inequitable conduct) will not suffice in such circumstances.

LaBounty Manufacturing, Inc. 958 F.2d at 1076, citing FMC Corp. v. Manitowoc Company, Inc., 835 F.2d 1411, 1416 (Fed.Cir.1987).

An applicant need not submit a prior art reference "if the reference teaches no more than what a reasonable examiner would consider to be taught by the prior art already before the PTO." Regents of Univ. of California v. Eli Lilly & Co., 119 F.3d 1559, 1575 (Fed.Cir.1997).

PM contends that Luke misrepresented the significance of the Ten Cent cigarette as prior art. We have agreed with B & W earlier in this opinion that the Ten Cent cigarette was not known or used in the United States prior to Luke's invention. This position was taken by Luke in his reissue application and thus we find that the Ten Cent was not improperly represented to the patent examiner.

PM's concern lies in the fact that the examiner stated that "there is no basis or motivation to modify the cigarette described in these exhibits to have a burn rate within the range of 25 to 45 mg/min." DX 10, p. 162. PM suggests that Luke deceived the examiner by making a comparison of the TUE he calculated of the Ten Cent and an orthodox cigarette, because he did treat the Ten Cent as a filtered cigarette in his calculation so as to have comparable items.

The court does not find the representations regarding the Ten Cent to be deliberately misleading. As specifically stated by Luke, he did not have an actual specimen of the Ten Cent to test himself. Therefore he relied upon the 1969 data he obtained for the cigarette. From the data sheets, he determined that the TUE for this unfiltered cigarette was approximately 88 mg of tobacco per puff, a TUE similar to that of an orthodox (25 mm) cigarette. What PM believes is misleading is that the puff counts given in the laboratory reports were for an *unfiltered* cigarette and thus were calculated utilizing a different protocol than is mandated for

measuring filtered cigarettes. PM suggests that had Luke treated the unfiltered Ten Cent cigarette as a filtered cigarette, using the filtered cigarette puff count measuring protocol, he would have come up with a filtered Ten Cent puff count number. PM's position is that the burn rate for a filtered Ten Cent cigarette (which did not exist) would have been in the 25 to 45 mg/min range.

The court is not convinced that such a measurement was either necessary or appropriate here. First, the Ten Cent was an unfiltered cigarette, was described as such, and was measured using the appropriate puff count protocol for the item. Luke reported actual data for the cigarette as it existed. Luke did not calculate a TUE for a variation or reconfiguration of the Ten Cent. He did not attempt to reconfigure a Ten Cent cigarette, as he believed it to be different in kind from his cigarette-"chalk and cheese," as he described it. Deceptive intent cannot be inferred from these circumstances.

Luke compared the TUE of the Ten Cent calculated from the data sheets to the TUE of an orthodox cigarette. Luke's statement of comparison does nothing more than suggest that he found the TUE of the unfiltered Ten Cent to be unacceptably high as he did the orthodox filtered cigarette. As this court concluded earlier, Luke made his calculations based upon the data he possessed. The puff count was presumably obtained using the standard protocol for unfiltered cigarettes. The Ten Cent was at all times identified by Luke as unfiltered and was "chalk" to his "cheese."

PM has also failed to prove by clear and convincing evidence that the attorneys who drafted the patent application, Lamb and MacLean, knew that the Resnick article was material prior art and deliberately withheld the reference with the intent of misleading or deceiving the PTO. They have consistently take the position that the Resnick article was not pertinent to the reissue proceeding. This position was based upon a fair reading of the article and an evaluation of the scientific data contained within it. The data is limited to cigarette circumferences no smaller than 22 millimeters. Luke as well as other colleagues believed that extrapolation of the data points beyond the tested range was bad science. We do not believe that Resnick standing alone provides the answer or motivation to reduce circumference below 22 mm. *See* Kolmes v. World Fibers Corp., 107 F.3d 1534, 1541 (Fed.Cir.1997) (There must be a showing of a suggestion or motivation to modify reference). The German examiner did not incorporate other reference in support of his position nor did he identify a motivation to extrapolate Resnick's data points. In the absence of a motivation to do so, MacLean and Lamb were justified in dismissing the conclusion of the German examiner as "bad science" in the U.S. patent proceeding.

We conclude that PM has failed to establish fraud on the PTO and cannot prevail on its defense of unenforceability.

D. WILLFULNESS

Title 35, United States Code, Section 284 provides for up to three times the amount of damages assessed if an infringer, having notice of a patent, acts willfully in disregard of the patentee's rights.

B & W contends that PM's infringement of the '615 patent was willful. PM responds that it believed, in good faith, that the '615 patent was invalid for obviousness. An invalid patent cannot be enforced by the inventor. As noted in Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 146, 109 S.Ct. 971, 975, 103 L.Ed.2d 118 (1989):

From their inception, the federal patent laws have embodied a careful balance between the need to promote

innovation and the recognition that imitation and refinement through imitation are both necessary to invention itself and the very lifeblood of a competitive economy.

This court must assess PM's conduct looking at "the totality of the circumstances," and consider:

(1) whether the infringer deliberately copied the ideas or design of another;

(2) whether the infringer, when he knew of the other's patent protection, investigated the scope of the patent and formed a good-faith believe that it was invalid or that it was not infringed; and

(3) the infringer's behavior as a party to the litigation.

Bott v. Four Star Corp., 807 F.2d 1567, 1572 (Fed.Cir.1986). The determination regarding willful infringement is a factual finding, Bott, 807 F.2d at 1572, and must be proven by B & W by clear and convincing evidence. Pall Corp. v. Micron Separations, Inc., 66 F.3d 1211, 1221 (Fed.Cir.1995).

The law imposes an affirmative duty of due care to avoid infringement of the known patent rights of others. Usually this duty includes seeking and obtaining competent legal advice before engaging in activity that may result in infringement.

Stryker Corp. v. Intermedics Orthopedics, Inc., 96 F.3d 1409, 1414 (Fed.Cir.1996).

The question of whether infringement is willful is one of fact and, as such, is reviewable under the clearly erroneous standard. Minnesota Mining and Manufacturing Co. v. Johnson & Johnson Orthopaedics, Inc., 976 F.2d 1559, 1580 (Fed Cir.1992), citing Ryco, Inc. v. Ag-Bag Corp., 857 F.2d 1418, 1428 (Fed.Cir.1988).

A court must look at whether "under all the circumstances, a reasonable person would prudently conduct himself with any confidence that a court might hold the patent invalid or not infringed." Ryco, Inc., 857 F.2d at 1428.

The *Minnesota Mining* case discusses legal advice regarding infringement:

[A] potential infringer having actual notice of another's patent has an affirmative duty of due care that normally requires the potential infringer to obtain competent legal advice before infringing or continuing to infringe. Ryco, 857 F.2d at 1428, 8 USPQ2d at 1332. However, legal advice is only one factor to be considered.... The emphasis here must be on "competent" legal advice.... As this court has recognized, oral opinions are not favored [citations omitted]. Such opinions carry less weight, for example, because they have to be proved perhaps years after the event, based only on testimony which may be affected by faded memories and the forces of contemporaneous litigation.

Minnesota Mining, 976 F.2d at 1580.

Whether infringement is "willful" is by definition a question of the infringer's intent [citations omitted].... While an opinion of counsel letter is an important factor in determining the willfulness of infringement, its importance does not depend upon its legal correctness. Indeed, the question arises only where counsel is wrong. Rather, Counsel's opinion must be thorough enough, as combined with other factors, to instill a

belief in the infringer that a court might reasonably hold the patent invalid, not infringed, or unenforceable.

Ortho Pharmaceutical Corp. v. Smith, 959 F.2d 936, 944 (Fed.Cir.1992); *see also,* Radio Steel & Mfg. Co. v. MTD Products, Inc. 788 F.2d 1554 (Fed.Cir.1986).

PM obtained a written opinion regarding the validity of the '410 patent in July of 1987. It became necessary for PM to obtain another opinion when it became aware of the reissue patent. PM did not receive a written opinion addressing the '615 patent until July 25, 1989 when it obtained the Fitzpatrick Cella opinion and August 11, 1989 when it obtained the second Fish & Neave opinion.

PM manufactured VSSS cigarettes on three separate occasions prior to the formal launch of the brand. These acts of manufacture occurred in February, June, and July of 1989. PM contends that the manufacture of these cigarettes was an "experimental use," and not actionable by B & W.

In Roche Products, Inc. v. Bolar Pharmaceutical Co., Inc., 733 F.2d 858, 862 (Fed.Cir.1984), the Federal Circuit delineated when experimental use does not constitute an infringement:

Thus where it is made or used as an experiment, whether for the gratification of scientific tastes, or for curiosity, or for amusement, the interests of the patentee are not antagonized, the sole effect being of an intellectual character in the promotion of the employer's knowledge or the relation afforded to his mind. But if the products of the experiment are sold, or used for the convenience of the experimentor, or if the experiments are conducted with a view to the adaptation of the invention to the experimentor's business, the acts of making or of use are violations of the rights of the inventor and infringements of his patent. In reference to such employments of a patented invention the law is diligent to protect the patentee, and even experimental uses will be sometimes enjoined though no injury may have resulted admitting of positive redress.

Emphasis in original.

Thus the "tuning up" of the machines for production of VSSS, and the Ad/Pack distributions in March of 1989, though not extensive, were very clearly steps taken in the process of gearing up for a launch of the VSSS cigarette. The manufacture of these cigarettes constituted acts of infringement, as they were manufactured with a view toward the adaptation of this cigarette design and construction to the business of Philip Morris.

PM has also suggested that the February, June, and July, 1989 manufacturing should not be found to constitute willful infringement because it produced only *de minimus* quantities on these occasions. The fact that no direct monetary injury may be shown from such acts of infringement is immaterial. When the manufacture is conducted with a view to the adaptation of the invention to the experimentor's business, "[i]t is obvious ... that it is a misnomer to call the intended use *de minimus*. It is no trifle in its economic effect on the parties even if the quantity used is small." Roche Products, Inc. v. Bolar Pharmaceutical Co., Inc., 733 F.2d 858, 863 (Fed.Cir.1984).

The question, then, is whether the oral opinions obtained from Fish & Neave were sufficiently thorough and reliable to justify a good faith belief held by PM that it was not infringing a valid patent.

The court has determined that there is insufficient documentation with respect to the purported oral opinion

from Fish & Neave on April 17, 1988. While the opinion may have been given, there is no contemporaneous documentation suggesting it, nor documenting the content of the opinion given at that time. In light of the significant changes in the language of the patent and the claims which were added, PM was no longer justified in hanging its hat on the ' 410 patent opinion it obtained. It is worth noting that Fish & Neave had obtained the file wrapper less than two weeks before the purported opinion was rendered, and that little time was logged by the attorneys during that period. Additionally, the billing records reveal a practice at Fish & Neave to carefully document the scope of its billable work, both in diary entries and billing records. When oral opinions were conveyed, the events were so documented. In the case of the April 7, 1988 meeting, no such notation was made by any attorney who participated in that meeting.

We find the case of Kalman v. Berlyn Corp., 914 F.2d 1473 (Fed.Cir.1990), upon which PM heavily relies to be factually distinguishable from the case at bar. In *Kalman,* Berlyn obtained written opinions some four years before manufacturing its products that the patent in issue was invalid. It obtained later oral opinions on non-infringement which were put into writing after it began selling its products. The patent in issue in *Kalman* was not altered as was the '410 patent, the predecessor to the patent in issue in this case. Therefore, the written opinions on invalidity obtained by Kalman remained viable and Kalman relied upon them in good faith. By contrast, PM obtained a written opinion that the '410 patent was invalid prior to manufacturing its product. However, the reliability or soundness of that opinion as called into question by the reissue of the '410 patent as the ' 615 reissue in which many new claims were added, virtually all of the language was rewritten, and new references were cited to the PTO. We do not find that *Kalman* and the case before us are in any way comparable. We conclude that the infringement which occurred in February and March of 1989 through PM's manufacture and distribution of VSSS cigarettes was willful.

We reach a different result with respect to the June and July acts of manufacture. The oral opinions received by PM in March and May of 1989 were the result of extensive study, and are substantially documented. As noted in detail in the findings of fact, the billing records establish the history leading up to the rendering of the opinions. The content of the May opinion, which is represented as a reiteration of the opinion which was given in March, is detailed in an outline prepared for use during the May meeting. There is extensive indicia of reliability with respect to these opinions, and we conclude that PM was justified in its good faith belief in the opinions it obtained at this time. Its belief was further bolstered by the January, 1988 rejection of the Luke cigarette by the German tribunal. While this foreign decision has no direct bearing here, PM's position with respect to obviousness surely found reassurance in that German decision. *See* Bic Leisure Products, Inc. v. Windsurfing International, Inc., 1 F.3d 1214, 1223 (Fed.Cir.1993).

It is unknown whether the July manufacture occurred before or after PM received the written opinion of the Fitzpatrick Cella firm. It is not significant, however, in light of our determination that PM was justified in relying upon the March and May oral opinions.

As noted in the findings of fact, we find that B & W did not adequately establish that PM decided on a September launch of VSSS in March of 1989, and will not address that date with respect to the question of willful conduct.

CONCLUSION

The court has concluded in this matter, with respect to PM, that the VSSS cigarette infringes the '615 patent, and that the manufacture and distribution of these cigarettes in February and March of 1989 was willful conduct. We have also concluded that B & W did not engage in inequitable conduct before the PTO, and

that the '615 patent is invalid for obviousness. Therefore, we will enter judgment in this matter in favor of PM, and there will be no trial on the issue of damages.