United States District Court,
D. Delaware.

PIPE LINERS, INC. and Hydro Conduit Corporation,
Plaintiffs.
v.
PIPELINING PRODUCTS, INC,
Defendant.

No. Civ.A. 98-164(SLR)

Oct. 22, 1999.

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MEMORANDUM OPINION

ROBINSON**, J.**

I. INTRODUCTION

Plaintiffs Pipe Liners, Inc. and Hydro Conduit Corporation filed this suit against defendant Pipelining Products, Inc. on April 2, 1998 alleging infringement by defendant of U.S. Patent No. 4,985,196 ("the '196 patent"), which discloses a method for *in situ* installation of thermoplastic liner within a host pipe. Before the court is defendant's motion for summary judgment. (D.I.15) For the following reasons, the court shall grant in part and deny in part defendant's motion.

II. BACKGROUND

The '196 patent, of which plaintiff Pipe Liners is an assignee, discloses a method for lining pipes with a thermoplastic tube. The patent principally addresses the need for an economical and efficient means to fix damaged underground pipes, specifically sewer pipes. As underground sewer pipes age, they tend to crack and leak sewage into the ground. (D.I. 17 at A382) Excavating and replacing these pipes is often expensive and causes disruption and inconvenience. Prior to the issuance of the patent in suit, a French inventor named Jacques Laurent developed and patented a method of repairing damaged pipes without having to excavate them. Because the Laurent patent discloses technology similar to that at issue in this case, a brief discussion of the Laurent patent will facilitate analysis of the '196 patent.

The Laurent patent, which is prior art in the present suit, utilizes the "elastic memory" properties of thermoplastics to line underground pipe. This elastic memory property allows manufacturers to heat a thermoplastic conduit to a given temperature, called the shape memory activation temperature, and deform the plastic into a different shape. Although the thermoplastic tends to remain in this deformed state, it keeps

a "memory" of its original undeformed shape. If the thermoplastic is reheated to its shape memory activation temperature, it will return to its initial dimensions. The Laurent patent discloses a method of deforming a circular thermoplastic tube at its shape memory activation temperature into a reduced, U-shaped cross section, which facilitates insertion of the tube into a length of host pipe. Thereafter, the deformed thermoplastic tube may be reheated to its shape memory activation temperature, which causes the tube to return to its initial circular dimensions and, thus, conform to the interior walls of the damaged pipe. The Laurent process thereby creates a new, plastic pipe within an existing host pipe without need of significant excavation.

The applicants for the '196 patent characterize their invention as an improvement on the Laurent process. (D.I.17, Ex. 2, col.1, lns.16-19) The '196 patent's specification describes the invention as providing

an improved method and apparatus for installing temporarily deformed pipe liner within a pipeline, expanding the deformed liner to its original cylindrical shape, taking additional steps causing the liner to conform even more precisely to the interior contour of the pipe, and flaring opposite ends of the liner into engagement with respective radially directed pipe flanges.

(D.I.17, Ex. 2, col.1, lns.57-64) (emphasis added). These "additional steps" refer to a combination of heat and pressure that causes the liner to expand further and fit snugly within the host pipe, thus eliminating the problems of "annular or other pockets of air between the liner and the inner pipe wall" associated with the Laurent pipelining process. (D.I. 17, Ex. 2, col 3, lns. 35-37)

The '196 patent contains two independent claims (claims 1 and 12) and eighteen dependent claims. The Patent and Trademark Office issued Reexamination Certificate B1 4,985,196 on November 18, 1997, which added dependent claims 21 and 22. (D.I. 17, Ex. 2, at A016) In the preferred embodiment, the pipe liner is constructed of high density polyethylene ("HDPE") and, at installation, temporarily deformed into a U-shaped cross section. FN1 (*See, e.g.,* D.I. 17, Ex. 2, Fig. 5, at A005) The specification of the '196 patent also incorporates by reference U.S. Patent No. 4,863,365 ("the '365 patent"), which discloses "a specific method and apparatus for manufacturing temporarily deformed thermoplastic conduit." (D.I.17, Ex. 2, col.1, lns.43-45) The specification of the '196 patent explains that the invention may be practiced such that "the liner is temporarily collapsed in a manner described in [the '365 patent]." (D.I.17, Ex. 2, col.1, ln.68-col.2., ln.4) The manner of temporarily collapsing thermoplastic tubing is described by the '365 patent as follows:

FN1. Plaintiffs' pipelining method is known by the trade name U-Liner(R))). (D.I. 17, Ex. 2, col. 4, ln. 15; Ex. 3 at A382)

It is an object of this invention to deform an initially extruded tubular cross section without adverse effect on its structural integrity, and in such a manner that its initially extruded cross section can be restored. To this end, controlled heat is applied to establish a softened condition of the thermoplastic material after its extrusion, while simultaneously applying deforming tools thereto in order to reduce its cross sectional configuration.
(D.I. 65, Tab 1, Ex. C, col. 1, lns. 52-60) The specification of the '365 patent then provides an example of a method for deforming an extruded thermoplastic liner:
The extruder means E is state of the art and receives the raw thermoplastic material and forces it through a[n] extrusion die 17 at, for example, 250 (deg.)>>>to 300 (deg.)F, using heating means 18 to attain that temperature. The cooling means C1 is state of the art, and preferably a vacuum cooling means supported by a vacuum cooling unit 19 and reducing the tube form temperature to, for example, 160 (deg.)F. The deformer apparatus D is subject to heating means H that maintains the desired deformation temperature of, for example, 160 (deg.)F.... [I]t is to be understood that the aforementioned temperatures can vary as circumstances require.

(D.I. 65, Tab 1, Ex. C., col. 5, lns. 6-16, 20-22)
Independent claims 1 and 12 of the '196 patent teach essentially the same process of installing a thermoplastic liner in a host pipe. Initially, plaintiffs alleged infringement of both claims, but plaintiffs since have advised defendant that they will not assert claim 1 of the '196 patent. (D.I. 64 at 1-2) Thus, only claims 12-22 of the '196 patent are at issue. Unlike the '365 patent's specification, claim 12 of the '196 patent does not provide specific temperatures at which the deformation of the thermoplastic occurs. Claim 12 teaches

a process for installing in situ a thermoplastic liner in a generally horizontally extending, generally cylindrical pipe, comprising the steps of:

(a) providing an elongate hollow liner formed of thermoplastic material having a cross-section altered at a shape memory activation temperature from a generally cylindrical cross-section having an original outer diameter substantially comparable to the inside diameter of the pipe to be lined to a reduced cross-section having reduced cross-sectional dimensions to enable the liner to be pulled into the pipe, said liner in said altered cross-section having a predetermined wall thickness;

(b) inserting said altered liner into said pipe such that end portions of said liner extend beyond opposite ends of said pipe;

(c) partially expanding the liner ends portions which extend beyond the opposite ends of the pipe by mechanical means inserted into said liner end portions such that said expanded liner end portions approximate the original cylindrical shape of said liner;

(d) sealing the expanded liner end portions beyond the opposite ends of said pipes to seal the interior of said liner at its opposite ends;

(e) subsequent to the step of sealing the liner and while maintaining the liner sealed, generally conforming said liner to the interior wall of the pipe while maintaining substantially the original predetermined wall thickness by (1) injecting a heated fluid into and through said sealed liner, (2) pressurizing the interior of said liner to a first predetermined pressure above atmospheric pressure by means of said heated fluid and (3) reheating said liner to a predetermined temperature by heat transfer from said heated fluid to said liner, whereby, the liner returns substantially to its remembered cylindrical cross-section; and

(f) then increasing the pressure in said liner to a second predetermined pressure above said first predetermined pressure to conform the liner substantially precisely to the interior wall surface contours of the pipe; and

(h) while the liner is still hot, introducing a cooling fluid into the liner for flow therethrough to fix the liner in final form in conformance to the interior wall of the pipe. FN2

FN2. There is no element (g) to claim 12.

(D.I.17, Ex. 2, col.10, lns.60-68, col.11, lns.1-37, col.12, lns.1-2)

In its motion for summary judgment, defendant argues that its pipelining process, known by the trade name Sure-Line(R), does not infringe claim 12 of the '196 patent either literally or under the doctrine of equivalents because the Sure-Line(R) process does not: (1) deform the thermoplastic conduit "at a shape memory activation temperature;" (2) utilize "a second predetermined pressure" to substantially conform the liner to the host pipe wall; (3) cool the liner following a second predetermined pressurization stage; or (4) have a liner with a diameter "substantially comparable to" the inside diameter of the pipe to be lined. (D.I. 17, Ex. 2, col. 10, ln. 65; col. 11, lns. 31-32; col. 10, lns. 67-68) Defendant also contends that claim 12 is

invalid on its face for omitting an essential element of the disclosed invention. Before addressing each of these arguments, the court first must construe the disputed claim language.

III. CLAIM CONSTRUCTION

It is the court's "power and obligation to construe as a matter of law the meaning of language used in the patent claim." Markman v. Westview Instruments, Inc., 52 F.3d 967, 979 (Fed.Cir.1995), *aff'd,* 517 U.S. 370 (1996). The principles of claim construction are well established. The exercise begins with the claim language, which defines the scope of the claim. *See* York Prods., Inc. v. Central Tractor Farm & Family Ctr., 99 F.3d 1568, 1572 (Fed.Cir.1996). In analyzing claim language, the court must employ "normal rules of syntax," Eastman Kodak Co. v. Goodyear Tire & Rubber Co., 114 F.3d 1547, 1553 (Fed.Cir.1997) for "[a] claim must be read in accordance with the precepts of English grammar." In re Hyatt, 708 F.2d 712, 714 (Fed.Cir.1983). The court also must ascribe to any technical term used in a claim "the meaning that it would be given by persons experienced in the field of the invention, unless it is apparent from the patent and the prosecution history that the inventor used the term with a different meaning." Hoechst Celanese Corp. v. BP Chems., Ltd., 78 F.3d 1575, 1578 (Fed.Cir.1996).

In order to give context to the claim language, the court also must review the specification. The Federal Circuit has explained that

[t]he specification acts as a dictionary when it expressly defines terms used in the claims or when it defines terms by implication.... As we have repeatedly stated, "claims must be read in view of the specification, of which they are a part." ... The specification contains a written description of the invention which must be clear and complete enough to enable those of ordinary skill in the art to make and use it. Thus, the specification is always relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of the disputed term.

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

The last source of intrinsic evidence relevant to claim construction is the prosecution history of the patent where, as here, it is in evidence. The prosecution history contains the complete record of all the proceedings before the Patent and Trademark Office, "including any express representations made by the applicant regarding the scope of the claims." Id. at 1583. The prosecution history, therefore, "is often of critical significance in determining the meaning of the claims." *Id*. Extrinsic evidence of claim meaning, on the other hand, is improper in most instances. *See id*. Extrinsic evidence includes expert testimony.

A. "Shape Memory Activation Temperature"

1. Plaintiff's Proposed Construction

Claim 12(a) of the '196 patent requires that the elongate, hollow thermoplastic liner have a cross-section altered at "a shape memory activation temperature." (D.I.17, Ex. 2, col.10, ln.65) Neither the claims nor the specification of the '196 patent provide a specific temperature associated with the term "shape memory activation temperature." Plaintiffs argue for a functional interpretation of that term, which would include a range of temperatures-including any temperature "above ambient temperature, which still allows the deformed liner to remain sufficiently deformed for insertion of the liner into a host pipe." (D.I. 127 at 33)

As an initial matter, the court notes that neither plaintiffs nor the '196 patent provide a definition of "ambient." Plaintiffs appear to use "ambient" to refer to normal, "room" temperatures, but they do not specify what those temperatures might be. Commonly understood, "ambient" means "[t]he temperature of the environment in which an experiment is conducted or in which any physical or chemical event occurs." Richard J. Lewis, Sr., *Hawley's Condensed Chemical Dictionary* 48 (13th ed.1997). Ambient, then, could refer to a wide array of temperatures and, if applied to the construction of "shape memory activation

temperature," it would deprive that claim limitation of any meaning.

Nonetheless, plaintiffs point to the claim language itself for support of this functional interpretation of "shape memory activation temperature." Plaintiffs argue that the term "shape memory activation temperature" is limited "functionally, namely to enable the altered liner to be pulled into the host pipe." (D.I. 128 at 8) The claim language "to enable the liner to be pulled into the pipe," however, does not modify "shape memory activation temperature;" rather, it modifies "having reduced cross-sectional dimensions." (D.I. 17, Ex. 2, col 11, lns. 2-3) Thus, the claim language itself sheds no light on the scope of the term "shape memory activation temperature." FN3

FN3. For these reasons, the court also declines to accord any weight to the testimony of plaintiffs' expert. Plaintiffs' expert, Stanley Mruk, construed the term "shape memory activation temperature" to mean "any temperature above ambient which enables the liner to be temporarily deformed while retaining a memory of the liner's original shape (reformed) by heating the pipe liner to a temperature at or above the temperature used in the deformation of the pipe liner." (D.I. 67 at 4, para. 9) Mruk's construction thus rests on an undefined term (i.e., "ambient") as well as an implausible reading of the claim language.

Plaintiffs also rely heavily on the '365 patent's specification as support for their functional interpretation of shape memory activation temperature. Specifically, plaintiffs point to that patent's description of "a desired deformation temperature of, for example, 160 (deg.)F." (D.I. 65, Tab 1, col. 5, lns. 15-16) Plaintiffs contend that the '196 patent's incorporation of the '365 patent compels the conclusion that shape memory activation temperature "can vary as circumstances require." (D.I. 65, Tab 1, Ex. C., col. 5, Ins. 21-22) A careful reading of the '365 patent reveals, however, that the term "shape memory activation temperature" never appears therein. Indeed, both the 160 (deg.)F cited by plaintiffs as a shape memory activation temperature and the phrase, "temperatures [that may] vary as circumstances require," relate merely to the "desired deformation temperature" of the preferred embodiment described in the '365 patent's specification. (D.I. 65, Tab 1, Ex. C ., col. 5, In. 15) Other than plaintiffs' conclusory assertion, there is no basis for equating the '365 patent's use of the term "deformation temperature" with the '196 patent's specific use of "shape memory activation temperature"-a highly technical term capable of precise calculation. (*See, e.g.,* D.I. 17, Ex. 3 at A363 (providing formula for crystallization temperature, which the coinventor equates with shape memory activation temperature at D.I. 17, Ex. 3 at A351)).

Because the meaning of the term "shape memory activation temperature" is not apparent from the patent, the court must turn to the prosecution history to determine the "meaning that it would be given by persons experienced in the field of invention." *See* Hoechst Celanese Corp., 78 F.3d at 1578. The prosecution history reveals that plaintiffs took pains to convince the Examiner that "shape memory activation temperature" referred to a specific range of temperatures, identifiable by calculation or by reference to the "specification sheet" of particular thermoplastics, which lists the thermoplastic's crystallization point.

2. The Prosecution History

Because the prosecution history plays such a significant role in determining the meaning of "shape memory activation temperature," the court shall review it in considerable detail. Plaintiffs filed their initial patent application in October of 1987. In this initial application, the proposed specification of the patent referred to 160 (deg.)F as the temperature at which deformation of the thermoplastic liner occurred. (D.I. 17, Ex. 3 at A025) Claim 1 of the initial application also disclosed a process for "altering the cross-sectional shape of the liner to reduce the cross-sectional dimension thereof at a shape memory activation temperature of about 160-180 (deg.)F." (D.I. 17, Ex. 3 at A044) In July of 1988, the Examiner denied claims 1 through 18 of the application as obvious in light of the Laurent patent and other prior art. (D.I. 17, Ex. 3 at A082-088)

In response, plaintiffs amended claim 1 to add, "so as to permit the liner to be pulled into the pipe,"

following that claim's recitation of a shape memory activation temperature "of about 160-180 (deg.)F." (D.I. 17, Ex. 3 at A102) In February of 1989, however, the Examiner again rejected claim 1 for, among other reasons, obviousness. (D.I. 17, Ex. 3 at A112-118) Plaintiffs again amended their application in June of 1989 and canceled claim 1 along with other claims. Plaintiffs then added several new claims. Of these new claims, claim 31 disclosed a process for installing thermoplastic pipe and

(b) altering the cross-sectional shape of the liner to reduce the cross-sectional dimension thereof at a shape memory activation temperature of about 221-277 (deg.)F so as to permit the liner to be pulled into the pipe....

(D.I. 17, Ex. 3 at A141) Dependent claim 35 of these new amendments also disclosed "[a] process according to Claim 31 wherein said shape memory activation temperature is about 260 (deg.)F." (D.I. 17, Ex. 3 at A142) Similarly, claim 36 and its dependent claim 40 each disclosed shape memory activation temperatures of "about 221-277 (deg.)F" and 260 (deg.)F, respectively. (D.I. 17, Ex. 3 at A143-44)

Plaintiffs also added claim 41, the predecessor of claim 12 of the '196 patent. Initially, claim 41 taught merely "an elongate hollow liner formed of thermoplastic material having a cross-section altered at a shape memory activation temperature...." Although claim 41 did not provide a specific shape memory activation temperature, its dependent claims 47 and 50 each provided, "[a] process according to Claim 41, wherein said memory activation temperature is within a range of 221-277 (deg.)F." (D.I. 17, Ex. 3 at A146)

Significantly, in their remarks to the preceding amendments, plaintiffs' patent counsel explained that

the reference in the specification and claims to 160 (deg.)F as the melting temperature of the polyethylene liner material is incorrect.... Applicants enclose five specification sheets from various companies indicating that the melting temperature of polyethylene was a known parameter at a time prior to the date of this application and specifically known to lie within a range of 221-277 (deg.)F.

(D.I. 17, Ex. 3 at A147) It appears that plaintiffs' patent counsel equated "melting temperature" with "shape memory activation temperature." FN4 Each of the specification sheets referred to by plaintiffs' patent counsel pinpoint the melting temperature of the various thermoplastics as above 200 (deg.)> F. (D.I. 17, Ex. 3 at A163-67) Plaintiffs' patent counsel also submitted a declaration of one of the coinventors in which the coinventor confirmed that these specification sheets indicated melting points in the range of 221-277 (deg.)F. (D.I. 17, Ex. 3 at A162)

FN4. Later in the prosecution, however, the '196 patent's coinventor equates shape memory activation temperature with a thermoplastic's "crystallization temperature" and provided the Examiner with a formula for calculating that temperature. (D.I. 17, Ex. 3 at A363; *see also* A351)

Despite these amendments, the Examiner again rejected the newly added claims in September of 1989. (D.I. 17, Ex. 3 at A296-302) In rejecting the claims for, among other reasons, obviousness, the Examiner noted:

It is submitted that the steps of altering the tube's cross-section at 210 (deg.)>>F and heating to expand the tube in British Application -695 are inherently at the thermoplastic liner's shape memory activation temperature as recited in the instant claims. This temperature is dependent on particular material used.

(D.I. 17, Ex. 3 at A298) (emphasis added). Following this rejection of their newly added claims, plaintiffs again offered amendments to their application in December of 1989. (D.I. 17, Ex. 3 at A303-12) In their remarks to these amendments, plaintiffs' patent counsel distinguished the aforementioned "British Application -695" by noting that, unlike the British Application, "applicants require the cross-sectional shape of the liner to be reduced by altering such shape at a shape memory activation temperature of about

221-277 (deg.)F." (D.I. 65, Ex. 3 at A310) The British Application disclosed a process of deforming polyvinyl chloride ("PVC") tubing at "approximately 210 (deg.)F." (D.I. 17, Ex. 3 at A173) Plaintiffs' patent counsel argued strenuously that, "PVC does not have shape memory characteristics, and .... the temperature to which the liner is elevated in [the British Application] is not within the range claimed...." (D.I. 17, Ex. 3 at A310) Contrary to plaintiffs' current contention that shape memory activation temperature is a variable, "functional concept," plaintiffs' patent counsel also acknowledged that, "a shape memory activation temperature is a known property, for example, of polyethylene material, prior to this invention." (D.I. 17, Ex. 3 at A309)

In January of 1990, the Examiner rejected plaintiffs' application on the ground that the recitation of a shape memory activation temperature "of about 221-277 (deg.)F" constituted new matter. Further, the Examiner remarked that this "range would read on any number of polymers dependent on their exact composition." (D.I. 17, Ex. 3 at A325-26) In response to the Examiner's new matter objections, plaintiffs amended their application in April and again in May of 1990. (D.I. 17, Ex. 3 at A331-39; A340-61) In these amendments, plaintiffs deleted reference to 160 (deg.)F in the specification as the deformation temperature and replaced it first with 260 (deg.)F and, in May, with 235 (deg.)F. Plaintiffs' patent counsel explained this change in his remarks to the May 1990 amendments:

[I]t must be recognized that patent specifications are directed to those skilled in the art. A person skilled in this art would recognize 160 (deg.)>> F as an incorrect shape memory activation temperature simply by reference to the specification sheet for this particular type of material specifically disclosed as the preferred embodiment and available at the time of this filing. The person of ordinary skill in the art would be advised by such specification sheet of the actual shape memory activation temperature.

Also, materials such as nylon, Teflon and ABS are disclosed ... together with the Union Carbide material. All of those materials have shape memory activation temperatures above 200 (deg.)F as indicated on the additional specification sheets for each of those materials accompanying the Declaration of [the coinventor]. Consequently, a person of ordinary skill in the art would recognize that the temperature of 160 (deg.)F could not be the shape memory activation temperature and would be directed by those specification sheets to the appropriate shape memory activation temperature.

(D.I. 17, Ex. 3 at A351-52)

Also in May, plaintiffs canceled claims 31-35 and claim 47 of the application and amended claims 36 and 41. Plaintiffs removed from claims 36 and 41 FN5 any reference to a specific shape memory activation temperature. Thus, in May of 1990, claim 41 disclosed in relevant part:

FN5. Claims 36 and 41 were renumbered as claims 1 and 12, respectively, upon issuance of the '196 patent. (D.I. 17, Ex. 3 at A442)

[A]n elongate hollow liner formed of thermoplastic material having a cross-section altered at a shape memory activation temperature from a generally cylindrical cross-section having an original diameter substantially comparable to the inside diameter of the pipe to be lined to a reduced cross-section having reduced cross-sectional dimensions to enable the liner to be pulled into the pipe, whereby the liner is maintained in its reduced cross-sectional shape with substantially no tendency to return to its cylindrical cross-section and retains a memory of its cylindrical cross-section, said liner in said altered cross-section having a predetermined wall thickness....
(D.I. 17, Ex. 3 at A343)
In a final supplemental amendment filed in August of 1990, plaintiffs deleted all reference to a specific shape memory activation temperature from the specification and amended claim 41 to read as claim 12 now reads in the '196 patent. (D.I. 17, Ex. 3 at A431-38) In explaining these changes, plaintiffs' patent counsel

remarked:

Applicants have attempted to amend the specification to present the proper numerical temperature but without apparent success. Thus, by canceling the numerical temperature for the shape memory activation temperature, the patent issuing from this application will not be misleading and, of course, the actual value is disclosed in the file wrapper. The actual numerical temperature is also not necessary to the claims inasmuch as those claims do not specify the precise numerical shape memory activation temperature.

(D.I. 17, Ex. 3 at A437) (emphasis added).

Thus, the prosecution history reveals (1) that shape memory activation temperature is a specific temperature defined by the particular properties of the thermoplastic at issue, (2) that plaintiffs contemplated shape memory activation temperatures that were well above ambient temperature (assuming "ambient" refers to normal, "room" temperatures), and (3) that the patentee defined shape memory activation temperature first (and, apparently, erroneously) as a given thermoplastic's "melting point" and later as a thermoplastic's crystallization point. In defining shape memory activation temperature as a thermoplastic's crystallization point, the '196 patent's co-inventor declared that:

[4. The preferred embodiment's] crystallization point is given as 113 (deg.)>> C, or about 235 (deg.)F. This is the memory activation temperature for that particular material.

5. The crystallization temperature is a temperature defining the maximum crystallization speed and it may be obtained by the formula T_c ~=>>>>> (T_m + T_g)/2 where T_c is the crystallization temperature, T_m is the melting temperature and T_g is the glass transition temperature. Each of nylon, Teflon and ABS, as disclosed in this application as an alternative material to the specifically identified and preferred Union Carbide material has a crystallization temperature above 200 (deg.)>> F. This is evidenced by calculations and specification sheets for those materials....

(D.I. 17, Ex. 3 at A363-64) (emphasis added). The prosecution history thus establishes that shape memory activation temperature is not, as plaintiffs suggest, a "functional" concept that "can vary as circumstances require."

Instead, the prosecution history reveals that the coinventor himself regarded shape memory activation temperature as a known temperature ascertainable by calculation and dependent upon a given thermoplastic's physical properties. Accordingly, the court shall construe the term, "shape memory activation temperature," as the '196 patent's coinventor understood it-namely, as the crystallization point of a given thermoplastic, calculated according to the following formula:

T_c ~= (T_m + T_g)/2 where T_c is the crystallization temperature, T_m is the melting temperature and T_g is the glass transition temperature.

(D.I. 17, Ex. 3 at A363; *see also* A351 (equating shape memory activation temperature with a material's crystallization temperature)).

B. "Second Predetermined Pressure"

Elements (e)-(f) of Claim 12 disclose a two-step pressurization method designed to "conform the liner substantially precisely to the interior wall surface contours of the pipe." (D.I.17, Ex. 2, col.11, lns.33-35) Specifically, the '196 patent teaches

pressurizing the interior of said liner to a first predetermined pressure above atmospheric pressure by means of said heated fluid and (3) reheating said liner to a predetermined temperature by heat transfer from said

heated fluid to said liner, whereby, the liner returns substantially to its remembered cylindrical cross-section; and

(f) then increasing the pressure in said liner to a second predetermined pressure above said first predetermined pressure....

(D.I.17, Ex. 2, col.11, lns.23-33) (emphasis added). Both parties agree that the claim calls for a two stage pressurization process. The first stage of pressurizing the interior of the liner must return the liner to its remembered cylindrical cross-section. The second stage of pressurization must "be above said first predetermined pressure to conform the liner substantially precisely to the interior wall surface contours of the pipe." (D.I.17, Ex. 2, col.11, lns.33-35) In the preferred embodiment, the pressure rises to about seven bars during the first pressurization stage and to about fifteen bars during the second pressurization stage. (D.I.17, Ex. 2, col.3, lns.31-32, 40) The claims and the specification reveal that both the first and second pressures must be "predetermined." Although the patent does not specifically define "predetermined," the court shall construe it, according to its ordinary meaning, as "determined beforehand." *Webster's Third New International Dictionary* 1786 (unabridged ed.1993). That is, the exact pressurization of the liner must be known before the pressurization process begins. Based on the plain meaning of the claim language, the second predetermined pressurization stage begins after the liner has returned "substantially to its remembered cylindrical cross-section." The court notes, however, that there is no limitation on how long the first predetermined pressure must be maintained after the rerounding of the liner and before the commencement of the second pressurization stage.

The court, therefore, shall construe the term "second predetermined pressure" to mean a pressure, determined before the second pressurization stage begins, which is above the first predetermined pressure and which conforms the liner substantially precisely to the interior of the host pipe.

C. The Cooling Step

Claim 12(h) discloses a step designed to set the liner in its final form within the host pipe. To this end, the claim teaches the following:

(h) while the liner is still hot, introducing a cooling fluid into the liner for flow therethrough to fix the liner in final form in conformance to the interior wall of the pipe.

(D.I.17, Ex. 2, col.11, lns.36-col.12, ln.2) Defendant contends that this cooling stage must occur after the second pressurization stage. Plaintiffs, on the other hand, argue that the cooling stage can occur contemporaneously with the second pressurization stage.

As an initial matter, the court notes that the claim language itself indicates that the cooling stage disclosed in element (h) occurs after the second pressurization stage taught in element (f). The cooling stage described in element (h) is required to "fix the liner in final form in conformance to the interior wall of the pipe." (D.I. 17, Ex. 3, col. 11, ln. 37-col.12, Ins. 1-2 (claim 12(h)) This "final form" cannot be achieved without "increasing the pressure in said liner to a second predetermined pressure ... to conform the liner substantially precisely to the interior wall surface contours of the pipe." (D.I. 17, Ex. 3, col. 11, Ins. 31-35 (claim 12(f))

The '196 patent's specification provides further support for construing claim 12 to require the cooling stage to occur after the second predetermined pressurization stage. After describing the second predetermined pressurization stage of the preferred embodiment, the specification states:

Thereafter, valve 60 is closed, hot water supply 58 disconnected, and the hot water within the pipe is emptied. The packer/expander assemblies 52, 54 are then withdrawn. It is a further feature of this invention that, while the liner is still hot, a conventional expansion pig, having a diameter substantially identical to the

inside diameter of the expanded liner, is introduced into the pipe 10 and is pushed through the pipe section applying a radial force to the liner so as to squeeze any remaining air from between the pipe liner and to thereby conform 100% of the liner surface against the interior surface of the pipe. The pig is preferably driven by a supply of cold water which more or less "freezes" the plastic into final form behind the pig, eliminating all air spaces between the liner and pipe section.

(D.I.17, Ex. 3, col.8, Ins.11-25) (emphasis added). Thus, both the claim language itself and the specification contemplate a cooling stage after the second predetermined pressurization stage. Therefore, the court shall construe claim 12(h) as requiring the cooling stage to occur sometime after the second predetermined pressurization stage.

D. The Diameter of the Liner

Claim 12(a) provides "an elongate hollow liner ... having an original outer diameter substantially comparable to the inside diameter of the pipe to be lined...." (D.I.17, Ex. 3, col.10, Ins.63-68) The parties dispute the scope of the term "substantially comparable to." Defendant contends in its claim construction briefs that "substantially comparable to" means the liner must be equal to or larger in diameter than the host pipe. (D.I. 121 at 22) Plaintiffs argue that "substantially comparable to" encompasses pipe liners "slightly less than, equal to, or slightly greater than the host pipes into which they are being installed." (D.I. 127 at 15)

The ordinary meaning of "substantially comparable to" the inside diameter of the pipe includes diameters slightly less than, equal to, or slightly greater than the host pipe diameter. "Substantial" is defined as "being that specified to a large degree or in the main." *Webster's* at 2280. A liner diameter that is "to a large degree" comparable to the diameter of a host pipe includes liner diameters that approximate the diameter of the host pipe. Thus, pipe liners with diameters that "substantially compare to" the diameters of their host pipes include diameters slightly smaller than, equal to, or slightly greater than the host pipe diameter.

Defendant, however, contends that the ordinary meaning of "substantially comparable to" does not control because the intrinsic evidence of the '196 patent is inconsistent with this meaning. Only two situations provide sufficient justification for defining a claim term in a manner other than its ordinary and accustomed meaning. *See* Johnson Worldwide Assocs., Inc. v. Zebco Corp., 175 F.3d 985, 990 (Fed.Cir.1999). The first of those situations occurs when a patentee has chosen to be his or her own lexicographer by clearly setting forth an explicit definition for a claim term. *See id*. This is not the case here. The other situation occurs when the term or terms chosen by the patentee so deprive the claim of clarity that there is no means by which the scope of the claim may be ascertained from the language used. *See id*.

Defendant urges that the intrinsic evidence of the '196 patent deprives the term "substantially comparable to" of its ordinary meaning. Defendant specifically points to the '365 patent specification, which explains that,

[i]n practice, the liner configuration has an outside diameter equal to or slightly greater than the inside diameter of the pipe to be protected, whereby the said liner is either unstressed or under slight circumferential compression....

(D.I. 65, Tab 1, Ex. C., col. 1, Ins. 40-47) (emphasis added). Defendant also notes that the '196 patent specification describes the preferred embodiment as having "a diameter slightly larger than the interior diameter of the pipe to be lined." (D.I.17, Ex. 3, col.1, Ins.65-69) (emphasis added). Each of these specifications, however, describes the preferred embodiment, and a description of the preferred embodiment cannot limit a claim term. *See, e.g.,* Johnson Worldwide Assocs., 175 F.3d at 992. Moreover, defendant admitted in its reply brief in support of summary judgment that claim 12 "is broad and necessarily covers diameters that are smaller than the pipe to be lined." (D.I. 71 at 19) Accordingly, there is no compelling reason to deprive the term "substantially comparable to" of its ordinary meaning. The court shall construe

the term "substantially comparable to" as encompassing pipe liners slightly less than, equal to, or slightly greater than the host pipes into which they are being installed.

With these constructions of the disputed claims in mind, the court now turns to defendant's motion for summary judgment.

IV. STANDARD OF REVIEW

A court shall grant summary judgment only if "the pleadings, depositions, answers to interrogatories, and admissions on file, together with the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to judgment as a matter of law." Fed.R.Civ.P. 56(c). The moving party bears the burden of proving that no genuine issue of material fact exists. *See* Matsushita Elec. Indus. Co. v. Zenith Radio Corp., 475 U.S. 574, 586 n. 10 (1986). "Facts that could alter the outcome are 'material,' and disputes are 'genuine' if evidence exists from which a rational person could conclude that the position of the person with the burden of proof on the disputed issue is correct." Horowitz v. Federal Kemper Life Assurance Co., 57 F.3d 300, 302 n. 1 (3d Cir.1995) (internal citations omitted). If the moving party has demonstrated an absence of material fact, the nonmoving party then "must come forward with 'specific facts showing that there is a genuine issue for trial." ' Matsushita, 475 U.S. at 587 (quoting Fed.R.Civ.P. 56(e)). The court will "view the underlying facts and all reasonable inferences therefrom in the light most favorable to the party opposing the motion." Pennsylvania Coal Ass'n v. Babbitt, 63 F.3d 231, 236 (3d Cir.1995). The mere existence of some evidence in support of the nonmoving party, however, will not be sufficient for denial of a motion for summary judgment; there must be enough evidence to enable a jury reasonably to find for the nonmoving party on that issue. *See* Anderson v. Liberty Lobby, Inc., 477 U.S. 242, 249 (1986). If the nonmoving party fails to make a sufficient showing on an essential element of its case with respect to which it has the burden of proof, the moving party is entitled to judgment as a matter of law. *See* Celotex Corp. v. Catrett, 477 U.S. 317, 322 (1986).

V. ANALYSIS

A. Literal Infringement

Arguing that it does not deform its liner at the liner's shape memory activation temperature, defendant moves for summary judgment that its Sure-Line(R) process does not literally infringe claim 12 of the '196 patent. A finding of literal infringement requires that the asserted claims read on the accused process. *See* Morton Int'l, Inc. v. Cardinal Chem. Co., 5 F.3d 1464, 1468 (Fed.Cir.1993). A claim covers, or reads, on an accused process if every limitation recited in the claim is found in the accused process. *See* Kahn v. General Motors Corp., 135 F.3d 1472, 1477 (Fed.Cir.1998). Each limitation of the claim must be met exactly by the accused process, and any deviation from the claim precludes a finding of literal infringement. *See* Lantech, Inc. v. Keip Mach. Co., 32 F.3d 542, 547 (Fed.Cir.1994). If an express claim limitation is absent from an accused process, there can be no finding of literal infringement as a matter of law. *See* Kahn, 135 F.3d at 1477.

The court has construed shape memory activation temperature to mean the crystallization point of a given thermoplastic, calculated according to the following formula:

$T_c \sim= (T_m + T_g)/2$ where T_c is the crystallization temperature, T_m is the melting temperature and T_g is the glass transition temperature.

Viewed in light of this construction, the record evidence conclusively establishes that defendant's Sure-Line(R) process does not literally infringe claim 12(a)'s requirement that the pipe liner be deformed at a "shape memory activation temperature." Plaintiffs do not dispute that defendant deforms its liners at a temperature ranging between 120 (deg.)F and 145 (deg.)F. (D.I. 17 at A455-59; D.I. 65 at B120) Nor do

plaintiffs dispute that defendant employs a high density polyethylene liner material with a crystallization point ranging between 126 (deg.)C to 130 (deg.)C (258.8 (deg.)F to 266 (deg.)F). (D.I. 17 at A455-59) Thus, there is no dispute that defendant's deformation temperature range of 120 (deg.)F to 145 (deg.)F falls far short of its liner's shape memory activation temperature range of 258.8 (deg.)F to 266 (deg.)F. Because an express claim limitation of the '196 patent is, therefore, absent from the accused Sure-Line(R) process, there can be no finding of literal infringement as a matter of law. *See* id. Accordingly, the court shall grant defendant's motion that it does not literally infringe the '196 patent.

B. Infringement Under the Doctrine of Equivalents

Although an accused device may not literally infringe a claim limitation, it may infringe under the doctrine of equivalents if "the differences between the claimed invention and the accused device ... are 'insubstantial." ' Texas Instruments Inc. v. Cypress Semiconductor Corp., 90 F.3d 1558, 1563-64 (Fed.Cir.1996). A finding of insubstantiality turns on whether "the element of the accused device at issue performs substantially the same function, in substantially the same way, to achieve substantially the same result, as the limitation at issue in the claim." Dawn Equip. Co. v. Kentucky Farms Inc., 140 F.3d 1009, 1016 (Fed.Cir.1998). Although the doctrine of equivalents "extends the protection of the patent beyond the literal words of the claims, it is not proper 'to erase a plethora of meaningful structural and functional limitations of the claim on which the public is entitled to rely in avoiding infringement." ' Malta v. Schulmerich Carillons, Inc., 952 F.2d 1320, 1327 (Fed.Cir.1991) (quoting Perkin-Elmer Corp. v. Westinghouse Elec. Corp., 822 F.2d 1528, 1532 (Fed.Cir.1987)). The United States Supreme Court has indicated that the particular linguistic framework used to test equivalency is not important, so long as it addresses the "essential inquiry [of whether] the accused product or process contain[s] elements identical or equivalent to each claimed element of the patented invention." Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520 U.S. 17, 40 (1997). The Court emphasized that, "[t]he determination of equivalence should be applied as an objective inquiry on an element-by-element basis." *Id*. In the context of a summary judgment motion, "[w]here the evidence is such that no reasonable jury could determine two elements to be equivalent, district courts are obliged to grant partial or complete summary judgment." *Id*. at 39 n. 8.

1. "Shape Memory Activation Temperature"

At issue is whether genuine issues of material fact exist with respect to whether defendant's method of deforming its pipe liner performs substantially the same function, in substantially the same way, to achieve substantially the same result as the process disclosed by element (a) of claim 12. *See, e.g.,* Dawn Equip. Co., 140 F.3d at 1016. The facts underlying this inquiry are not in dispute. The only question before the court concerns the scope of the claim term "shape memory activation temperature" and whether this term encompasses, by virtue of the doctrine of equivalents, temperatures manifestly below a given thermoplastic's shape memory activation temperature. Because this is a legal (as opposed to factual) dispute, it is amenable to resolution by the court on summary judgment.

From the evidence of record, it is apparent that defendant's Sure-Line(R) process performs the same function as that taught in element (a) of claim 12. Like element (a), the Sure-Line(R) process alters the cross-section of the thermoplastic pipe liner to enable the liner to be pulled into the host pipe. The way in which the Sure-Line(R) process performs this function, however, differs substantially from that disclosed by element (a) of claim 12. It is undisputed that defendant alters the cross-section of its thermoplastic liners by heating them to a range of 120 (deg.)F to 145 (deg.)F, which is substantially below the thermoplastic liner's shape memory activation temperature. Element (a) of claim 12, on the other hand, calls for alteration of the pipe liner's generally cylindrical cross-section "at a shape memory activation temperature." Thus, as the prosecution history conclusively establishes, the two processes employ significantly different temperatures in order to deform their liners. This difference in temperature produces substantially different results. A thermoplastic liner altered at a shape memory activation temperature "has substantially no tendency to return to its original shape once the deforming stresses are removed." (D.I. 17 at A356) On the other hand, a

liner deformed according to the Sure-Line(R) process will reround after deformation unless restrained by tensile tape. (D.I. 65 at B058-059, B067-069) In short, element (a) teaches the use of a thermoplastic liner's memory activation properties to produce a liner that necessarily "has substantially no tendency to return to its original shape." Defendant's process, however, does not exploit the memory activation properties of thermoplastics and, as a consequence, its process requires the additional step of wrapping its deformed liners in tensile tape until the liner's insertion into the host pipe.

Thus, to ignore the significance of element (a)'s use of "shape memory activation temperature" and to conclude that the Sure-Line(R) process is the substantial equivalent of element (a) would allow element (a) "such broad play as to effectively eliminate that element in its entirety." Warner-Jenkinson, 520 U.S. at 29. Allowing the term "shape memory activation temperature" to encompass the temperatures at which defendant deforms its liners would erase a meaningful functional limitation of the claim upon which defendant was entitled to rely in avoiding infringement. *See* Perkin-Elmer Corp., 822 F.2d at 1532. This conclusion is buttressed by the fact that plaintiffs distinguished the '196 patent from prior art by touting the patent's use of memory activation properties. For example, in distinguishing a prior art patent's ("the Steketee patent") use of PVC as a pipe liner, plaintiffs explained that, "PVC does not have shape memory characteristics, and, consequently, the cross section of the PVC liner in Steketee is not shaped ... with respect to any shape memory activation temperature at all." (D.I. 17 at A310) In light of the substantial difference between defendant's deformation process and that disclosed by element (a), no reasonable jury could find defendant's deformation process equivalent to element (a) of claim 12. Accordingly, the court shall grant defendant's motion for noninfringement of the '196 patent. In light of this conclusion, the court need not address defendant's other arguments in support of noninfringement under the doctrine of equivalents.

D. Defendant's Invalidity Argument

Finally, defendant argues that claim 12 of the '196 patent omits an essential element of the invention and, therefore, is invalid for failure to comply with written description requirement of s. 112, para. 1 of the patent act. *See* 35 U.S.C. s. 112. Because courts presume patents are valid, the movant on summary judgment must establish invalidity by clear and convincing evidence. *See* Electro Med. Sys. S.A. v. Cooper Life Sciences, 34 F.3d 1048, 1052 (Fed.Cir.1994). Defendant contends that claim 12, which provides for a liner with a diameter "substantially comparable to" the inside diameter of the host pipe, includes liners with "smaller" diameters and, therefore, conflicts with the '196 patent's specification, which describes only liners with "larger" diameters. Although s. 112 does not explicitly recognize an "omitted element" cause of action, the Federal Circuit appears to have so interpreted s. 112. *See* Gentry Gallery, Inc. v. Berkline Corp., 134 F.3d 1473, 1479 (Fed.Cir.1998); *see also* Purdue Pharma, L.P. v. F.H. Faulding & Co., 48 F.Supp.2d 420, 427-28 (D.Del.1999); Reiffin v. Microsoft Corp., No.C-98-0266-VRW, 1998 WL 397915, at *3 (N.D.Cal. Jul. 10, 1998) (recognizing an "omitted element test"); Cindy I. Liu, Comment, 14 Berkeley Tech. L.J. 123 (1999) (analyzing the *Gentry Gallery* opinion).

In *Gentry Gallery,* an owner of a patent for a sectional sofa brought an infringement action against a competitor. The patent in suit disclosed a sectional sofa containing two parallel reclining seats separated by a fixed console, which the original disclosure of the invention described as containing the controls for reclining the seats. This original disclosure did not suggest any alternative location for the controls. *See* Gentry Gallery, 134 F.3d at 1479. Nonetheless, Gentry asserted subsequently added claims covering sofas in which the controls were not located on the console. Berkline argued that these subsequently added claims were invalid for omitting an essential element of the invention. In siding with Berkline, the Federal Circuit ruled that the patent owner could not assert claims that omit elements of the invention as originally disclosed, where one skilled in the art would recognize that the omitted element was essential to the invention as originally disclosed. Id. at 1479-80; *accord* Reiffin, 1998 WL 397915, at *3. In applying this "omitted element" test, the Federal Circuit looked to the original disclosure of the invention, to the broadest original claim, and to the inventor's statements in the prosecution history. *See id.* at 1479. Each of these

sources demonstrated that placement of the controls on the console was "the only possible location for the controls." *Id*.

In the present case, the original disclosure of the '196 patent described the invention as an improvement over the Laurent prior art, which utilized a liner with "an outside diameter ... approximately equal to the inside diameter of the pipe to be lined." (D.I. 17, Ex. 3 at A024) The improvement relates to, *inter alia,* "causing the liner to conform even more precisely to the interior contour of the pipe." (D.I. 17, Ex. 3 at A025-26) The disclosure explains that, "[t]o this end, thermoplastic material is extruded and calibrated to obtain a cylindrical insert liner with a diameter slightly larger than the interior diameter of the pipe to be lined." (D.I. 17, Ex. 3 at A026) At no point does the original disclosure (or, for that matter, the final version of the disclosure statement) declare that "larger" diameters are essential to the invention.

Claim 1, as originally filed, disclosed no restrictions on the liner's diameter. (D.I. 17, Ex. 3 at A044) Moreover, the applicants' statements regarding the necessity for liners with diameters larger than the host pipe related to amendments to claim 1-amendments that added the "slightly larger than the interior diameter of the pipe to be lined" language. Plaintiffs also have submitted expert testimony that one skilled in the art would not regard a liner diameter larger than the host pipe's interior diameter as "essential" to the invention. (D.I. 67 at 20) For these reasons, defendant has failed to prove by clear and convincing evidence that claim 12 is invalid for omitting an essential element. Accordingly, the court shall deny defendant's motion for summary judgment that claim 12 is invalid.

VI. CONCLUSION

For the aforementioned reasons, the court shall grant defendant's motion that it does not infringe the '196 patent either literally or under the doctrine of equivalents. Defendant's motion is denied in all other respects. An appropriate order shall issue.

D.Del.,1999.
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