

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

OMEGA LINER COMPANY, INC.,

Petitioner

v.

BUERGOFOL GMBH,

Patent Owner

U.S. Patent No. 8,794,269

Filing Date: November 30, 2012

Issue Date: August 5, 2014

Title: TUBULAR FILM AND THE USE THEREOF

IPR Case No. IPR2023-01402

DECLARATION OF DR. STEVEN B. MACLEAN, PH.D., P.E.

LIST OF EXHIBITS

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EX1020	Abdel-Bary, E., <i>Handbook of Plastic Films</i> (2003), pp. 5-40
EX1021	Alam, S., <i>Experimental and Numerical Evaluation of Cured-in-Place Pipe Lining System for High Temperature Applications in Sewer Pipes</i> (2011), pp. 32-51
EX1022	Bennett, R., <i>Guidelines for Trenchless Technology: Cured-in-Place Pipe (CIPP), Fold-and-Formed Pipe (FFP), Mini-Horizontal Directional Drilling (Mini-HDD), and Microtunneling</i> (1995), pp. 2-1 - 2-7
EX1023	Callister, W., <i>Materials Science and Engineering: An Introduction, Eighth Edition</i> (2010), pp. 537-540, 610-614
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EX1027	Mark, H., <i>Encyclopedia of Polymer Science and Technology, Third Edition</i> (2004), pp. 189-222 (Vol. 8)
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EX1029	Namhata, S. P., et al., <i>Rationalisation of Vicat Softening Point Measurements</i> (1990), pp. 75-89
EX1030	Nwabunma, D., et al., <i>Polyolefin Blends</i> (2008), pp. 3-12, 14-16
EX1031	Odian, G., <i>Principles of Polymerization, Fourth Edition</i> (2004), pp. 3-16, 27-29

EX1032	Olabisi, O., <i>Conventional Polyolefins</i> (1997), pp. 1-38
EX1033	Salem, S., et al., <i>Use of Trenchless Technologies for a Comprehensive Asset Management of Culverts and Drainage Structures</i> (2008), pp. 45-51
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I, Steven B. MacLean, Ph.D., P.E, do hereby declare the following:

1. I have personal knowledge of the facts contained in this Declaration, am of legal age, and am otherwise competent to testify about the matters set forth herein.

I. SCOPE OF THE ENGAGEMENT

2. I have been retained by Neustel Law Offices, Ltd. on behalf of Omega Liner Company, Inc. (“Petitioner” or “Omega”) to provide analysis and opinion in connection with an *inter partes review* (“IPR”) petition to be filed before the United States Patent and Trademark Office (“USPTO”) Patent Trial and Appeal Board (“Board”). I understand that my testimony will be submitted with the IPR petition to be considered by the Board.

3. I understand that the petition for IPR involves U.S. Patent No. 8,794,269 (“the ’269 Patent”).

4. My employer, Exponent, is being compensated for my time at my normal consulting rate of \$650 per hour for preparing this declaration.

5. My compensation in this matter is not in any way contingent on my performance, the outcome of this proceeding, or any of the issues involved therein. Exponent is also being reimbursed for expenses incurred as a result of activities performed as an expert.

6. I have no business interest in Omega, and I have no business interest in Buergofol GMBH. (“Buergofol”).

II. BACKGROUND AND QUALIFICATIONS

7. I am a Principal Engineer and the Practice Director of Polymer Science and Materials Chemistry Practice at Exponent, which is based in Menlo Park, California and founded in 1967. Exponent is the largest technical consulting firm in the country that assists clients across multiple industries with root cause investigations, intellectual property matters, regulatory guidance, and product development efforts. As the Practice Director, I lead a technical staff of approximately 70 practicing scientists and engineers, all of whom hold advanced degrees in polymer science, materials engineering, chemistry or other related disciplines.

8. I hold four academic degrees: 1) a Bachelor of Science degree in Mechanical Engineering from Rensselaer Polytechnic Institute; 2) a Master of Engineering degree in Mechanical Engineering from Rensselaer Polytechnic Institute; 3) a Master of Science degree in Materials Science and Engineering from Rochester Institute of Technology; and 4) a Doctor of Philosophy degree in Materials Science from the University of Rochester. My chosen field of study during my graduate work in materials science was polymer science and engineering. I am also a registered Professional Engineer in New York and Maryland, a Senior Member of the Society of Plastics Engineers (SPE), and a board member of SPE's Failure Analysis and Prevention Special Interest Group. I

am an active, voting member of the ASTM International D20 Committee which develops and publishes consensus-based standards for polymeric materials and a member of Plastic Pipe Institute which establishes industry standards and specifications for polymeric pipe products.

9. During the pursuit of my advanced degrees in materials science, I successfully completed several graduate courses that specifically focused on polymers including, but not limited to, polymer science, organic polymer chemistry, polymer physics, polymer blends, polymer rheology, polymer processing, bulk physical properties of polymers, adhesion theory, and experimental and analytical techniques for polymeric materials. Supplemental course work included mechanics of materials, fracture mechanics, thermodynamics of materials and electron microscopy practicum.

10. At the master's degree level, my polymer research included characterizing the changes in chemical and physical properties of polycarbonate polymers due to multiple heat histories from processing. At the doctoral level, my polymer research was focused on the development of novel formulations of rubber-toughened polyphenylene ether polymers for use in pressurized, potable water delivery systems. Rubber systems developed and incorporated into my research included saturated styrene-ethylene-butylene-styrene (SEBS) block terpolymers and unsaturated butadiene polymers. The findings from my dissertation research

included quantifying changes in select mechanical properties, such as fracture toughness and tensile properties, due to the degrading effects from persistent exposure to chlorinated water at elevated temperatures. My masters-level and doctoral-level course work, in combination with my academic research endeavors, have provided me in-depth knowledge regarding the scientific principles that are required to formulate polymer compounds with desired chemical and physical properties, process those materials using lab-scale and industrial equipment and characterize the resultant formulation-structure-property relationships.

11. During my time in industry, I have held numerous technical roles with increasing responsibility at the General Electric Company (GE), SABIC, and Exponent. During my employment with these companies, I have either led or technically contributed to the material development, design, analysis, manufacturing or testing of hundreds of finished goods made from polymeric materials including thermoplastics, thermosets and elastomers using conventional processing techniques such as injection molding, thermoforming, blow molding, compression molding, extrusion and blown film.

12. While in several positions at GE and SABIC, I was a technical contributor to each business' New Product Introduction (NPI) process, in which polymer resin formulations were conceived, developed, tested, processed, and commercialized. The NPI process included creating brand-new formulations and

enhancing existing formulations based on market demands and defined customer requirements. On numerous occasions, I technically contributed to the development of new polymer formulations using my skills as a polymer scientist and engineer. Common raw material ingredients that were routinely employed in these polymer formulations included processing aids, lubricants, waxes, heat stabilizers, antioxidants, ultraviolet (UV) stabilizers, friction reducers, slip agents, flame retardant additives, mold release agents, colorants, curing agents, and inorganic fillers such as glass, carbon and minerals.

13. As an outlet for its resin products, GE/SABIC also produced numerous extruded, co-extruded or laminate products primarily for the building and construction market. Such products included ballistic resistant glazing, tornadic glazing, hurricane shutters and clear roofing panels. Although each product was unique in terms of its performance specifications and composition, each one was manufactured from polymeric materials in coating, film or sheet form. As such, I have years of first-hand experiences related to the material composition, fabrication processes, bulk properties, and functional performance of these types of products.

14. Over the course of my 25-year career as a polymer scientist and engineer, I have led numerous investigations into the development, manufacturing, quality control, testing and end-use performance of pipe materials made from

polymeric materials. My prior pipe experience includes, but is not limited to, pressure-driven water delivery piping, gravity-driven drain/waste/ventilation (DWV) piping, heating/ventilation/air conditioning (HVAC) piping, fire suppression piping, chemical plant piping, as well as gathering and distribution piping for the oil and gas industry. In addition, I routinely conduct failure analyses and root cause investigations related to underperforming pipes in the field, including cured-in-place piping (CIPP).

15. Since joining Exponent, I regularly consult on intellectual property matters related to the design and function of load-bearing articles manufactured from polymeric materials. Those matters include, but are not limited to, multi-layer plastic insulation, multi-layer hazardous waste containment bags, athletic cleats, tamper-resistant food packaging containers, vinyl flooring tiles, foamed rubber flooring tiles, testosterone applicators, tinea unguium applicators, insulin pen injectors, fracking pump header rings, and downhole drilling stators.

16. My qualifications and publications are set forth more fully in my *curriculum vitae*. See EX1004.

17. On the basis of my education and the personal and professional experiences described above and set forth in my curriculum vitae, I believe I am qualified to give the opinions set forth herein.

III. INFORMATION CONSIDERED

18. My opinions are based on my education and training as a polymer scientist and engineer, my 25 years of professional industry experience in the manufacturing of plastic goods and polymeric material formulation as well as my experience with the studies, investigations, and other matters on which I have given expert testimony. In forming my opinions, I have considered the following materials:

- The '269 Patent (EX1001)
- The '269 File History (EX1002)
- European Publication No. EP 0 267 742 A2 to Glover (EX1005)
- U.S. Patent No. 6,679,966 to Brandenburger (EX1006)
- Russian Publication No. RU 2182999 C1 to Khramenkov (EX1007)
- European Publication No. EP 0 342 897 A2 to Jones (EX1009)
- Buergofol's Website on Archive.org, 2004-2007, with accompanying Declaration of Nathaniel E. Frank-White (EX1010)
- U.S. Patent No. 4,009,063 to Wood (EX1011)
- U.S. Publication No. 2005/0194718 A1 Blades (EX1012)
- Buergofol's Opposition of European Pub. No. EP 2 582 520 B1 (EX1013)
- Chinese Office Action for Chinese Application No. CN 201180029444 A – English Translation from EPO (EX1016)

- Abdel-Bary, E., Handbook of Plastic Films (2003), pp. 5-40 (EX1020)
- Alam, S., Experimental and Numerical Evaluation of Cured in Place Pipe Lining System for High Temperature Applications in Sewer Pipes (2011), pp. 32-51 (EX1021)
- Bennett, R., et al., Guidelines for Trenchless Technology: Cured in Place Pipe (CIPP), Fold-and-Formed Pipe (FFP), Mini-Horizontal Directional Drilling (Mini-HDD), and Microtunneling (1995), pp. 2-1 – 2-7 (EX1022)
- Callister, W., et al., Materials Science and Engineering: An Introduction, Eighth Edition (2010), pp. 537-540, 610-614 (EX1023)
- Costa, F., Thermoplastic Elastomers (2009), pp. 101-146 (EX1024)
- Deopura, B., et al., Polyesters and Polyamides (2008), pp. 41-48 (EX1025)
- Donaldson, B., Water Quality Implications of Culvert Repair Options: Vinyl Ester Based and Ultraviolet Cured-in-Place Pipe Liners (2012), pp. 1-21 (EX1026)
- Mark, H., *Encyclopedia of Polymer Science and Technology, Third Edition* (2004), pp. 189-222 (Vol. 8) (EX1027)
- Mark, J., *Polymer Data Handbook* (1999), pp. 172-229, 518-528, 780-786 (EX1028)
- Namhata, S. P., et al., *Rationalisation of Vicat Softening Point Measurements* (1990), pp. 75-89 (EX1029)

- Nwabunma, D., et al., *Polyolefin Blends* (2008), pp. 3-12, 14-16 (EX1030)
- Odian, G., *Principles of Polymerization, Fourth Edition* (2004), pp. 3-16, 27-29 (EX1031)
- Olabisi, O., *Conventional Polyolefins* (1997), pp. 1-38 (EX1032)
- Salem, S., et al., *Use of Trenchless Technologies for a Comprehensive Asset Management of Culverts and Drainage Structures* (2008), pp. 45-51 (EX1033)
- Sterling, R., et al., *State of Technology of Rehabilitation of Wastewater Collection Systems* (2010), pp. 16-20, A-12 – A-17 (EX1034)
- *Pipeline Renewal Technologies, The Elements of CIPP: Cured-in-Place Materials and Processes* (2020), pp. 1-11 (EX1035)
- Ozaki, Y., et al. *Far-Ultraviolet Spectroscopy in the Solid and Liquid States: A Review* (2012), pp. 1-25 (EX1036)
- Ozaki, Y., et al. *Far-Ultraviolet Spectroscopy in the Solid and Liquid States: Characteristics, Instrumentation, and Applications* (2016), pp. 3962-3981 (EX1037)
- Cohen, S., *Design of UV-Absorbing Polypropylene Films with Polymeric Benzotriazole Based Nano- and Microparticle Coatings* (2016), pp. 868-875 (EX1038)
- Original Complaint, August 15, 2022, *Buergofol GmbH v. Omega Liner Company, Inc.*, Case No. 22-cv-04112-KES (D. S.D.) (Dkt. 1) (EX1040)

- First Amended Complaint, July 13, 2023, *Buergofol GmbH v. Omega Liner Company, Inc.*, Case No. 22-cv-04112-KES (D. S.D.) (Dkt. 169) (EX1043)
- Buergofol's Responses to Omega's Interrogatories to Buergofol (Set Two) (Nos. 6-13), March 31, 2023 (EX1044)
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19. My opinions directed to the invalidity of the challenged claims are based, at least in part, on the following prior art publications:

- European Publication No. EP 0 267 742 A2 (Glover)
- U.S. Patent No. 6,679,966 (Brandenburger)
- Russian Publication No. RU 2182999 C1 (Khramenkov)
- European Publication No. EP 0 342 897 A2 (Jones)

20. Additional information may become available which would further support or modify the conclusions that I have reached to date. Accordingly, I reserve the right to modify or expand this opinion or the bases thereof upon consideration of any further discovery, testimony, or other evidence, including any issues raised by any expert or witness of the patent owner, or based upon interpretations of any claim term different than those proposed in this declaration.

IV. PERSON OF ORDINARY SKILL IN THE ART

21. I understand that validity of a patent must be analyzed from the perspective of a hypothetical person of ordinary skill in the art in the same field as the patent. I have been informed that such hypothetical person of ordinary skill is presumed to be aware of all of the relevant art at the time of the invention, *i.e.*, the effective filing date of the application for the asserted patent. I have been informed that a person of ordinary skill would think along the lines of conventional wisdom in that art. The person of ordinary skill is not an automaton, and may be able to fit together the teachings of multiple patents employing ordinary creativity and the common sense that familiar items may have obvious uses in another context or beyond their primary purposes.

22. I have been informed that several factors to consider in determining the level of ordinary skill in the art include (i) the educational level of workers in the field, (ii) the types of problems encountered in the art, (iii) prior-art solutions to such problems, (iv) rapidity with which innovations are made, and (v) the complexity of the technology.

23. Based on my knowledge and experience, and taking into account each of the above-identified factors, it is my opinion that the person of ordinary skill in the art (“POSITA”) of the ’269 Patent at the time of the presumed effective filing date (*i.e.*, June 15, 2010) would have been a person with a bachelor’s degree in

Polymer Science and Engineering, Material Science and Engineering, or a related engineering field, combined with at least three years of experience in the formulation, manufacturing, and end-use performance of polymeric film and sheet products. Alternatively, one skilled in the art could be a person with at least seven years of experience in the formulation, manufacturing, and end-use performance of polymeric film and sheet products, without possessing a bachelor's degree in a related scientific or engineering discipline. Individuals with different educational backgrounds and additional experience could still be of ordinary skill in the art if that additional experience compensates for a deficit in their education and experience stated above. Additional education might substitute for some of the experience, and substantial experience might substitute for some educational background. I had those capabilities myself as of the presumed effective filing date as I was working directly in the field in question and consider myself a person of ordinary skill in the art as of at least June 15, 2010.

V. LEGAL PRINCIPLES

24. I use the legal principles below, of which I have been informed by counsel, as a guide in formulating my opinions.

A. Claim Interpretation

25. I have been informed that assessing the validity of a patent claim requires a two-step analysis. The first step involves the proper interpretation or construction of the claim language in order to determine its scope and meaning. The second step requires comparing the claim, as properly construed, to the alleged prior art to determine whether the limitations of the claim are met by the prior art.

26. I understand that in an *inter partes* review, claim terms are to be given their ordinary and customary meaning as understood by a person of ordinary skill in the art in the context of the entire disclosure at the time of the invention. I understand that one must be careful not to read a specific embodiment appearing in the written description into the claim if the claim language is broader than the embodiment. I further understand that any special definition for a claim term must be set forth with reasonable clarity, deliberateness, and precision.

27. I have been informed that this standard is the same as that used in United States district courts, in which claim terms are given their ordinary and customary meaning as would be understood by a person of ordinary skill in the art at the time of the invention having taken into consideration the language of the

claims, the specification, and the prosecution history of record under the *Phillips* claim construction standard.

B. Prior Art

28. It has been explained to me by counsel for Petitioner that information which satisfies one of the categories of prior art set forth in pre-America Invents Act (“pre-AIA”) 35 U.S.C. § 102 may be used in an invalidity analysis under §§ 102 or 103. If information is not properly classified as prior art under one of the subsections of § 102 of the Patent Code, then it may not form the basis of an anticipation or obviousness determination.

29. It is also my understanding that, for *inter partes* review, applicable prior art is limited to patents and printed publications.

30. It is my further understanding that in an IPR proceeding, a patent claim may be deemed invalid if it is shown by a preponderance of the evidence (*i.e.*, that the patent claim is more likely than not invalid) that the claim was anticipated by a prior art patent or publication and/or rendered obvious by one or more prior art patents or publications.

C. Obviousness

31. I have further been informed that a patent claim is invalid under pre-AIA 35 U.S.C. § 103(a) if it would have been obvious to a person of ordinary skill in the art in view of the prior art at the time the application was filed. In other

words, even though the claimed invention may not be identically disclosed or described in a single prior art reference, a patent claim is invalid for obviousness if the differences between the claimed invention and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains.

32. I have been informed that the following factors are used in making an obviousness determination: (i) the scope and content of the prior art are to be determined; (ii) the differences between the prior art and the claims at issue are to be ascertained; and (iii) the level of ordinary skill in the pertinent art resolved.

33. I understand that whether there are any relevant differences between the prior art and the claimed invention is to be analyzed from the view of a person of ordinary skill in the art at the time of the invention. I have been informed, for purposes of this IPR proceeding, to assume that the alleged date of invention for the challenged claims is March 11, 2013.

34. In analyzing the relevance of the differences between the claimed invention and the prior art, I understand that I must consider the impact, if any, of such differences on the obviousness or non-obviousness of the invention as a whole, not merely some portion of it.

35. The person of ordinary skill in the art faced with a problem is able to apply his or her experience and ability to solve the problem and also look to any available prior art to help solve the problem.

36. I understand that a reference may be modified and/or combined with one or more other references and/or with the knowledge of one of ordinary skill in the art if such person of ordinary skill in the art would have found the modification and/or combination obvious. In other words, I understand that I do not need to look for precise teaching in the prior art directed to the subject matter of the claimed invention. I understand that I may take into account the inferences and creative steps that a person of ordinary skill in the art would have employed in reviewing the prior art at the time of the invention.

37. In determining whether a piece of prior art could have been combined with other prior art or with other information within the knowledge of a person having ordinary skill in the art, it is my understanding that the following are examples of approaches and rationales that may be considered to support a conclusion of obviousness:

- Combining prior art elements according to known methods to yield predictable results;
- Simple substitution of one known element for another to obtain predictable results;

- Use of a known technique to improve similar devices, methods, or products in the same way;
- Applying a known technique to a known device, method, or product ready for improvement to yield predictable results;
- Applying a technique or approach that would have been “obvious to try” (choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success);
- Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to a person having ordinary skill in the art; or
- Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

38. I understand that if the claimed invention combined elements known in the prior art and the combination yielded results that were predictable to a person of ordinary skill in the art at the time of the invention, then this evidence would make it more likely that the claim was obvious.

39. I understand that an invention would have been obvious if a person of ordinary skill in the art, facing the wide range of needs created by developments in the field, would have seen an obvious benefit to the solutions tried by the applicant. When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, it would be obvious to a person of ordinary skill to try the known options. If a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique would have been obvious.

40. I understand that a key inquiry is whether any improvement allegedly achieved by a claimed invention is more than the predictable use of prior art elements according to their established functions.

41. I understand that a claimed invention may be obvious if some teaching, suggestion, or motivation exists that would have led a person of ordinary skill in the art to combine the invalidating references. I also understand that this suggestion or motivation may come from sources such as explicit statements in the prior art, or from the knowledge of a person having ordinary skill in the art. Alternatively, any need or problem known in the field at the time and addressed by the patent may provide a reason for combining elements of the prior art.

42. I also understand that when there is a design need or market pressure, and there are a finite number of predictable solutions, a person of ordinary skill may be motivated to apply both his skill and common sense in trying to combine the known options in order to solve the problem.

43. I understand that a reason to modify or combine prior art may support an obviousness determination, provided there is a reasonable expectation of success. I further understand that whether a proposed modification or combination of the prior art has a reasonable expectation of success is determined at the time the invention was made.

44. On the other hand, if the combination of known elements yielded unexpected or unpredictable results, or if the prior art teaches away from combining the known elements, then this evidence would make it more likely that the claim that successfully combined those elements was not obvious. I understand that hindsight must not be used when comparing the prior art to the invention for obviousness.

45. I am also aware that before concluding a claim is obvious, secondary considerations of non-obviousness, to the extent they exist, must be considered, such as: long-felt need, failure of others, copying by others, praise by others in the industry, licensing of the claimed invention, departure from accepted principles, widespread recognition by those in the art of the invention's significance, and

commercial success. I understand that there must be a demonstrated nexus between the claimed invention and these secondary considerations for them to be considered.

VI. TECHNOLOGY BACKGROUND

A. Cured-In-Place Pipe (CIPP)

46. Cured-in-place pipe (CIPP) is a trenchless technology (TT) used for rehabilitation of underground utility pipes, often in the application of municipal sewage. EX1033 at pp. 5-6. CIPP technology was first employed in a project in 1970 and 1971 to repair leaking or damaged underground pipelines without the need for excavation. EX1033 at p. 5, EX1035 at p. 2. CIPP technology was also patented in the mid 1970s. *See* United States Patent No. 4,009,063 to Wood (“Wood”), entitled “Method of Lining a Pipe.” EX1011 at p. 1. This first CIPP patent detailed a CIPP liner comprising “a laminate of non woven felt sandwiched between an outer membrane and an inner membrane of plastics sheet material.” EX1011 at p. 11, Claim 1. The nonwoven felt of the CIPP liner of Wood, made of synthetic fiber such as polyester, nylon, or acrylic fibers, is impregnated with a thermosetting resin prior to insertion into the pipe to be rehabilitated. EX1011 at p. 7, 2:33-44, p. 11, 9:64-65. In use, the CIPP liner of Wood is inserted into the pipe to be rehabilitated, inflated with fluid (e.g., air) pressure so that the liner conforms to the shape of the pipe, and then the resin in the nonwoven felt is cured either through ambient conditions or applied heat. EX1011 at p. 7, 2:33-44, p. 9, 5:25-42. The inner membrane may either become “firmly bonded” to the cured resin

impregnated nonwoven felt, or it may be easily removable, depending on the materials used for the inner membrane and curable resin. EX1011 at p. 9, 5:51-56.

47. In addition to providing bonding or release properties with the resin impregnated nonwoven felt, the inner membrane, as well as the outer membrane, have various performance requirements. Both the inner and outer membranes of the CIPP liner of Wood are required to be impermeable to fluids to prevent the migration of uncured resin from the nonwoven material and to allow the liner to be shaped with fluid pressure during installation. EX1011 at p. 11, 10:29-40. Further, the inner and outer membranes of the CIPP liner should be “somewhat elastic and capable of some extension” in order to conform to the shape of the host pipe during inflation of the CIPP liner during installation. EX1011 at p. 11, 9:44-50. The inner and outer membranes of the CIPP liner of Wood are made “in any convenient manner for example by extrusion” using “any suitable synthetic plastics or other material” such as “polythene, polyvinylchloride, butyl, rubber, cellophane nitrate, neoprene and polyester film.” EX1011 at p. 8, 4:30-32, p. 11, 10:24-29.

48. As early as March 2005, Buergofol was producing three-, five-, seven-, and fourteen-layer films via coextrusion of thermoplastic materials including polyamides and polyolefins for use in CIPP liners. An example layer sequence of the “Five-layer medium barrier” film described on Buergofol’s website is: “PA/TIE/PA/TIE/PE.” This layer sequence includes an external

polyamide layer, an internal polyamide layer, and an external polyethylene layer that are coextruded together with “tie” layers in between to ensure sufficient bonding between the layers. EX1010 at p. 7.

49. Current CIPP liners still utilize the architecture, materials, and similar installation practices as disclosed by Wood in 1975. Sometimes referred to as a “tube” or “insertion tube”, the CIPP is inserted into a previously existing pipe, expanded to fit flush within the pipe, and a curing method is employed to harden the resin system. EX1022 at p. 11. Insertion, expansion and curing can each occur via numerous methodologies.

50. The most basic form of a CIPP comprises a flexible tube and thermosetting resin system. The tube can consist of woven or non-woven felt, glass fiber cloth, or impermeable plastic. EX1022 at p. 10. Historically, the resin systems in use are unsaturated polyester, vinyl ester, or epoxy, with unsaturated polyester being the most commonly used material. EX1022 at p. 10. However, pipeline applications that require greater corrosion/solvent resistance and/or temperature performance may employ vinyl ester or epoxy resin systems. EX1022 at p. 10. CIPP liners may be composed of additional layers depending upon the intended installation and cure method. For example, insertion can occur via a “pull-in and inflate” method, in which additional internal and external layers are required to protect the resin material during the installation process. EX1033 at p. 9. These

two additional layers may be composed of different plastics and can be optimized for the specific installation and curing methods. CIPPs are manufactured to specification of the host pipe. EX1022 at p. 10. Because installation often occurs through inspection manholes, the liner should be manufactured to the appropriate distance or length (*i.e.*, that between manholes) and the diameter should be such that the liner is flush within the host pipe. EX1022 at p. 10. As such, CIPPs are often custom made for each project. EX1033 at p. 7.

51. Installation of CIPPs can occur via three methods: “inversion with air”, “pull-in and inflate”, and “pull-in and invert through”. EX1033 at pp. 8-9. Briefly, the “inversion with air” installation process involves inversion of the CIPP tube following the “wet out” process, in which the CIPP tube has been saturated with the resin system. EX1033 at p. 8. The inverted tube is often attached to an inversion device, and the resin is in contact with the existing host pipe. Following complete installation, the tube is cured with steam. EX1033 at p. 8. The “pull-in and inflate” method, disclosed by Wood in 1975, involves pulling the CIPP tube through the host pipe and then inflating it with air. In this installation method, the CIPP tube consists of an inner film layer (sometimes referred to as an *inner* foil, coating, or bladder layer) that permits inflation, and an outer film layer (also, sometimes referred to as an *outer* foil, coating, or bladder layer) that protects the CIPP and encases the impregnated fabric component. EX1033 at p. 9. The inner

and outer film layers are liquid tight to prevent the migration of the impregnated resin out of the fabric CIPP layer. EX1033 at p. 9, EX1034 at p. 11. The external layer additionally protects the CIPP liner from damage while being pulled into the host pipe during installation. EX1033 at p. 9. The preceding requirements and challenges for the “pull-in and inflate” method were all known and contemplated by Wood in 1975. Finally, the “pull-in and invert through” installation method involves two CIPP tubes saturated with resin. EX1033 at p. 9. The first tube is pulled-in to position and the second tube is inverted with air through the first tube. This method allows inflation of the first tube by the inversion of the second tube. The second tube may be saturated with resin material or could serve as a bladder that is ultimately discarded. EX1033 at p. 9-10.

52. Friction forces occurring during these various installation methods can result in damage to the CIPP liner. For example, when CIPP liners are pulled into place inside the host pipe to be repaired, there is inherent friction between the outer surface of the liner and the inside surface of the host pipe. This friction can damage the CIPP liner by ripping or puncturing at least the outer foil, which could result in resin washout from the carrier material and the inability of the liner to be inflated. Further, during the inversion process, liner-on-liner friction is a major challenge that could again lead to damage of the liner. EX1012 at p.3, [0013]-[0014].

53. Oil was initially used to reduce these friction forces present during CIPP liner installation. Oil could be coated or directly applied to the exterior surface of the CIPP liner to reduce friction forces while the liner is pulled into the host pipe. Oil was also applied on the inner liner-to-liner interface to reduce liner-on-liner friction that occurs when the inner surface of the CIPP liner inverts and moves to the outside of the liner and comes in contact with the host pipe. However, the CIPP industry has moved away from the use of oil to reduce these friction forces as it can be a costly, messy, and environmentally unfriendly process. EX1012 at pp. 3-4, [0016].

54. In order to achieve the reduction of friction forces innate to CIPP installation while avoiding the use of oils, coatings of other lubricants have been utilized. U.S. Publication 2005/0194718 A1 (“Blades”) entitled “Pipe Liners and Methods of Lining Pipes” details the use of lubricants including “polyethylene waxes, oxidized polyethylene waxes, fatty acid waxes, fatty acid ester waxes, amide waxes, metallic fatty ester waxes, and fatty alcohol waxes.” EX1012 at p. 4, [0029].

55. Following installation, the impregnated resin needs to be cured to harden and maintain its structure integrity. Curing can be accomplished through hot air, steam, UV light, or in some cases, ambient air is sufficient for the curing process. EX1033 at p. 7. Traditional curing techniques primarily utilize steam (*i.e.*,

water vapor produced from water at or above 100 °C), whereas UV curing is a newer technique used for specific CIPP liner types. EX1035 at p. 4, EX1026 at p. 7. UV curing was developed for use in CIPP liners in the early 2000s. EX1035 at p. 4. The employed curing technique will be somewhat dependent upon the installation method. For example, air inversion installation is generally associated with curing via steam, while the installation via the “pull-in and inflate” method allows for curing via steam, UV light, or hot air. EX1033 at pp. 8-9. During UV curing, a UV light train that emits UV light moves through the length of the inflated CIPP liner to cure the UV active resin impregnated in the carrier material along the entire length of the CIPP liner. EX1034 at p. 8, EX1035 at p. 4. Therefore, when UV curing is utilized, it is necessary that the inner film layer of the CIPP be transparent to UV light to allow the UV active resin to cure. EX1034 at p. 8, EX1035 at p. 3. Conversely, the outer film layer of the CIPP must block UV light to prevent premature curing of the UV reactive resin impregnated in the fabric layer (located between the inner film and the outer film of the CIPP) before installation. EX1034 at p. 8. Following curing, the inner film layer or bladder is typically removed from within the newly cured CIPP. EX1034 at p. 8.

56. The finished CIPP needs to be continuous across the host pipe with no lift or delamination from the host pipe inner wall. EX1033 at p. 11. Depending upon application, the CIPP will need to have some degree of chemical resistance to

withstand exposure to potentially damaging compounds that may be found in a sanitary system. EX1033 at p. 10. Additionally, the CIPP needs to be able to withstand minor thermally induced strains that may affect the fit of the CIPP within the host pipe. EX1021 at pp. 10, 15-16. Furthermore, the CIPP liner should be made to withstand external hydrostatic pressure to reduce the likelihood of buckling of the pipe. EX1021 at p. 23.

B. Thermoplastic Polymers

57. Polymers are macromolecules (*i.e.*, large molecules) formed by linking smaller repeat units together. EX1031 at p. 8. Polymers are typically organic in nature and frequently incorporate hydrogen and carbon atoms that are bonded together via covalent bonds. The macromolecule chains of a polymer can be made of single repeating units or can contain two or more types of repeating units; such systems are called copolymers. EX1023 at p. 7.

58. Polymers are classified into two different groups, thermoplastics or thermosets, based on their chemical compositions, structures, and physical properties. Thermoplastics are non-crosslinked polymers that soften and flow upon heating and reheating. EX1031 at p. 11. Conversely, thermosets do not flow when heated and contain anchor points, known as crosslinks, between polymer chains. Crosslinking refers to the joining of two polymer chains by a branch which forms a network structure. In general, due to the energy requirement to break additional

chemical bonds, crosslinking provides greater stability to withstand mechanical stress and higher temperatures. EX1031 at pp. 10-11. Conversely, thermoplastics lack the rigidity provided by crosslinked branches, and therefore have greater ability to flow when heated. This allows thermoplastics to be processed using melt-based processing methods, such as injection molding, extrusion, blow molding, and others. EX1023 at pp. 10-11, EX1024 at pp. 45-48. The liners used in CIPP systems are often made using thermoplastic felts and fibers, such as felt reinforced with polyester fibers, while the curable resin used to impregnate the fiber layer is an example of a thermosetting material. EX1034 at pp. 7, 11, 14, EX1022 at p. 10.

59. Polymers have a wide range of physical and chemical properties, including VICAT softening temperature or VICAT softening point. The VICAT softening point is a metric of a polymer's short-term resistance to heat. EX1027 at p. 16. It is measured by penetrating the material of interest with a needle at depth of 1 mm into the material of interest under controlled heating and loading conditions. EX1027 at p. 16.

60. Polyolefins, a widely used group of thermoplastics, are synthetic polymers composed of repeating units that contain an olefin, also called alkene, in which two carbon atoms are bonded together by a covalent double bond. EX1030 at pp. 4-5. As such, the chemical formula of polyolefins can be represented as C_nH_{2n} where n is the number of carbon atoms and needs to be greater than or equal

to 2. EX1030 at p. 5. The first polyolefins were polymerized in the 1920s and 1930s and the process was refined in the 1950s when catalysts were developed for polymerization. EX1030 at pp. 18-19. Polyethylene (PE) and polypropylene (PP) are commonly known homopolymer polyolefins that exhibit good chemical resistance, flexibility, high tensile strength, and are electrically insulating. EX1020 at p. 6, EX1028 at pp. 63, 74. Polyolefins can also be used in copolymers, such as ethylene- and propylene-based copolymers. EX1030 at p. 6, EX1032 at pp. 28-29. Further, polyolefins can be functionalized (*i.e.*, modified) to act as compatibilizers in blends and composites utilizing polyolefins. Examples of functionalized polyolefins include olefin copolymers or terpolymers with functional groups including epoxide, anhydride, hydroxyl, acrylate, and carboxylic acid. EX1030 at p. 8.

61. Standard isotactic grades of homopolymer polypropylene have VICAT softening points in the range of 145-150 °C. EX1032 p. 18. Standard (non-branched) grades of high density homopolymer polyethylene have softening points in the range of 120-130 °C, while standard grades of low density (branched) homopolymer polyethylene have a softening point in the range of 85-102 °C. EX1032 at p. 20, EX1028 at p. 69.

62. Polyamides are another type of thermoplastic in which its molecular structure contains a repeating amide unit. The molecular structure of a commonly

used polyamide, Nylon 6, is shown in Figure 1. Discovered as early as 1928 and introduced as a formalized product in 1938 (EX1025 at p. 5), polyamides are known for excellent mechanical strength at elevated temperatures, good abrasion and chemical resistance, and having a low coefficient of friction. EX1028 at pp. 12,19. Depending on the molecular variant, polyamides can possess VICAT softening points in the range of ~170-290 °C. EX1028 at pp. 12, 59, EX1029 at p. 4.

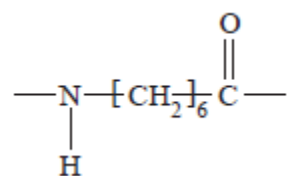


Figure 1. Molecular structure of Nylon 6. EX1028 at p. 19.

63. In addition to classifying polymers by the identity of a single repeating unit (*i.e.*, homopolymers), multiple types of repeating units can be combined to form a copolymer. EX1031 at p. 12. A simple example of a copolymer is the polyamide Nylon 6/6T which combines Nylon 6 monomer units with Nylon 6T monomer units as shown in Figure 2. The benefits of combining monomer units to generate a copolymer are that one can tune the chemical and physical properties. For example, in the case of Nylon 6/6T, the abundance of the ring structure can aid in adjusting the melting temperature, allowing this specific copolymer to be relevant for high temperature applications. EX1028 at p. 19.

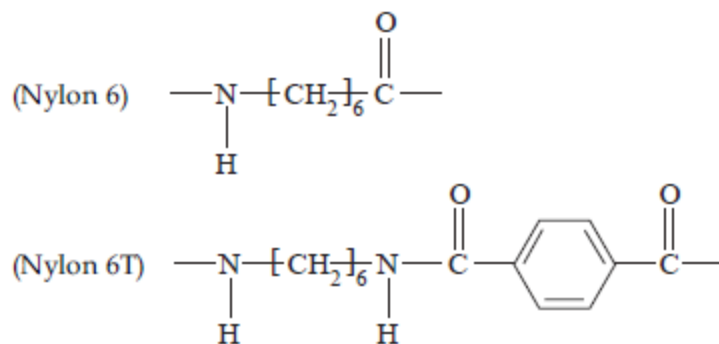


Figure 2. Monomer units of copolyamide Nylon 6/6T. EX1028 at p. 19.

C. UV Transmission of Polymers

64. Optical properties will vary with polymer chemical composition, blend, density, and specimen thickness. For example, low density polyethylene is known for its optical clarity, but can be modified to have optical clarity that varies from “near transparent to opaque.” EX1032 at p. 20, EX1028 at p. 63, *see also*, p. 71. While there are different mechanisms for tuning a polyolefin film for a target application, some films are inherently capable of 80% or greater light transmission within the ultraviolet spectrum. For example, some polyethylene grades have been shown to have about 80% transmission or higher in the range of 220-300 nm. EX1036 at p. 23. Polypropylene film has also demonstrated ~80% or greater transmission in the 250-400 nm wavelength range. EX1038 at p. 6. Variants of polyamides have also been found to have a range of optical clarities. In particular, there are a variety of commercially available Nylon materials that reportedly have relatively high UV permeability depending on the specific chemical structure of

the polymer with greater than 80% transmission in the range of 220-260 nm.

EX1037 at p. 8.

VII. OVERVIEW OF UNITED STATES PATENT NO. 8,794,269

65. United States Patent No. 8,794,269 was filed on November 30, 2012, and issued on August 5, 2014 to Henrik Hummel.

66. The '269 Patent is entitled "Multi-Layer Film Permeable to UV Radiation."

67. I have reviewed the '269 Patent (EX1001). I have also reviewed the file history for the '269 Patent (EX1002). I have provided descriptions of the '269 Patent that may be pertinent to my analysis below. As such, my descriptions and opinions herein are not intended to be a comprehensive discussion of an entire understanding of the '269 Patent.

A. Overview

68. The '269 Patent describes a multilayer film for use in CIPP liners:

It was therefore an object of the present invention to provide a multilayer film, in particular in the form of a tubular film, which is suitable as internally situated tube of an insertion tube for the renovation of subterranean pipes, preferably subterranean sewer pipes, since it has not only the necessary permeability to UV radiation but also mechanical properties that are sufficiently good for it to withstand the high loads that arise during pipe renovation.

EX1001 at p. 4, 2:20-27.

69. According to the '269 Patent, the multilayer tubular film for use as an inner tubular film for CIPP liners is required to be permeable to UV radiation to allow for UV curing of the CIPP liner. EX1001 at p. 4, 1:61-64. Further, the '269 Patent specifies that the multilayer inner tubular film must have sufficient

mechanical properties to withstand loads during the CIPP liner installation, such as insertion into the host pipe and inflation of the liner. Further, the '269 Patent specifies that the multilayer inner tubular film must be able to withstand the forces imparted on the inner tubular film when it is removed from the interior of the fully cured CIPP liner after installation has been completed. EX1001 at p. 4, 2:52-65. Additionally, the '269 Patent states that its "invention" allows all of these mechanical properties to be achieved without "prior conditioning." EX1001 at p. 4, 2:64-67. The '269 Patent also states that multilayer inner tubular film must be impermeable to liquids to prevent "drying-out of the resin used for pipe renovation." EX1001 at p. 4, 2:48-52.

70. The '269 Patent purports to achieve these objectives through a multilayer film comprising the following layer sequence:

- (a) a layer (a) based on at least one thermoplastic olefin homo- or copolymer, as one of the external layers, or surface layers,
 - (b) an adhesive-promoter layer (b),
 - (c) an internally situated layer (c) based on at least one homo and/or copolyamide,
 - (d) an adhesive-promoter layer (d), and
 - (e) a layer (e) based on at least one homo- and/or copolyamide, as one of the external layers, or surface layers,
- where the VICAT softening point of the thermoplastic olefin homo- or copolymer of the layer (a) is at least 100°C.

EX1001 at p. 4, 2:37-47.

71. The '269 patent further states that suitable olefins include ethylene homopolymers (*e.g.*, polyethylene), propylene homopolymers (*e.g.*, polypropylene), ethylene copolymers, propylene copolymers, and/or mixtures of at least two of the polymers mentioned. EX1001 at p. 5, 3:40-4:11. The VICAT softening point of layer (a) according to the '269 Patent should be at least 100 °C. EX1001 at p. 5, 4:12-16. The '269 Patent further describes that the “multilayer film of the invention is preferably sealable via layer (a)” to form a tubular film. EX1001 at p. 6, 6:19-20.

72. The '269 Patent also details the preferred materials for layers (c) and (e). According to the '269 Patent, layers (c) and (e) comprise at least one homo- and/or copolyamide, preferably “PA 6, PA 12, PA 66, PA 6I, PA 6T, or corresponding copolymers, or a mixture of at least two of the polyamides mentioned.” EX1001 at p. 5, 4:25-44. In one preferred embodiment of the '269 Patent, layers (c) and (e) have an identical layer structure, such as “identical layer thickness, and/or identical polyamide components, and/or an identical composition.” EX1001 at p. 5, 4:45-49. In an alternative preferred embodiment of the '269 Patent, layers (c) and (e) have a different layer structure, such as “different layer thickness, and/or different polyamide components, and/or an [sic] [different] composition.” EX1001 at p. 5, 4:50-54.

73. The '269 Patent similarly describes the preferred composition of the adhesive-promoter layers of the multilayer inner tubular film, layers (b) and (d):

It is particularly preferable that the adhesive-promoter layers (b) and (d) are respectively mutually independently based on at least one modified ethylene homo- or copolymer and/or at least one modified propylene homo- or copolymer modified with at least one organic acid or with at least one preferably cyclic organic anhydride, preferably maleic anhydride.

EX1001 at p. 6, 5:2-8.

74. The total layer thickness of the multilayer film of the '269 Patent is described to be between 20 and 2000 μm , which can be manufactured by any known conventional processes, such as casting, coextrusion, or blown-film coextrusion. EX1001 at p. 6, 5:40-6:6.

75. According to the '269 Patent, the multilayer film can be used as a part of a CIPP liner system for rehabilitating subterranean pipes, including the multilayer film as the inner tubular film, an additional film with either a single layer or multiple layers as the outer tubular film that reflects or absorbs UV radiation, and a carrier material impregnated with UV reactive resin situated between the inner and outer tubular films. The CIPP liner system according to the '269 Patent is installed in the pipe, inflated, and cured via UV light which is able to permeate the UV permeable inner tubular film. Following curing, the multilayer inner tubular film of the "invention" is "preferably withdrawn" from the cured support material. EX1001 at pp. 6-7, 6:60-7:10.

B. Prosecution History

76. The '269 Patent (Patent No. 8,794,269) was filed as United States Patent Application No. 13/690,076 (the "'269 Application") on November 30, 2012. EX1002 at p. 1. The '269 Application is a continuation of International Application PET/EP2011/002685 filed on May 31, 2011, which claims priority to German Patent Application No. 10 2010 023 764.7, filed on June 15, 2010. EX1002 at pp. 87, 172, *see also*, EX1002 at pp. 168-169.

77. International Application PET/EP2011/002685 included 10 claims. From the International Preliminary Report on Patentability of International Application PET/EP2011/002685, novelty of the film that forms the inner tube of the claim product ("insert tube") is characterized both by "having very good elasticity and by being able to be peeled off once the resin has cured." EX1002 at p. 223.

78. As originally filed, the '269 Application included 10 claims. Claims 1 and 10 were independent claims, while the remaining claims were all dependent claims that depended from claim 1. EX1002 at pp. 200-202. The inventor listed on the '269 Application includes Henrik Hummel. EX1002 at p. 162. In response to the Examiner's Notice of Incomplete Reply dated January 31, 2013, the replacement abstract to comply with the format requirement was submitted. EX1002 at pp. 230-232.

79. On May 23, 2013, the '269 Application published as U.S. Patent Application Publication No. 2013/0126029. EX1002 at p. 259.

80. On January 30, 2014, the Examiner issued a Notice of Allowance for the '269 Application. EX1002 at p. 260. The Examiner provided the following reasons for allowance:

81. “[T]he present invention is novel and non-obvious wherein no reference discloses a tube comprising a layer sequence ... as recited by claim 1”. EX1002 at p. 265.

82. On August 5, 2014, the USPTO issued an Issue Notification that the '269 Application would issue as the '269 Patent. EX1002 at p. 372.

C. Claims of the '269 Patent

83. I understand that Omega is challenging claims 1-10 of the '269 Patent. These claims recite:

Claim 1: An insertion tube suitable for the renovation of subterranean pipes, optionally subterranean sewer pipes, comprising

An optionally nonconditioned multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation, comprising a layer sequence made of

a layer (a) comprised of at least one thermoplastic olefin homo- or copolymer, as one of the external layers,

an adhesive-promoter layer (b),

an internally situated layer (c) comprised of at least one homo- and/or copolyamide,

an adhesive-promoter layer (d), and

a layer (e) comprised of at least one homo- and/or copolyamide, as one of the external layers,

in the form of a tubular film,

wherein the VICAT softening point of the thermoplastic olefin homo- or copolymer of the layer (a) is at least 100°C.;

as internally situated tube, and

an externally situated single- or multilayer tubular film which is impermeable to liquids, and which reflects and/or absorbs UV radiation and/or short-wave, visible light, as externally situated tube, and

a support material situated therebetween and saturated with a reactive synthetic resin.

Claim 2: The insertion tube as claimed in claim 1, wherein the thickness of the layer (a) is at least 40% of the total thickness of the multilayer film that is impermeable to liquids and at least to some extent permeable to UV radiation.

Claim 3: The insertion tube as claimed in claim 1, wherein the layer (a) of the multilayer film that is impermeable to liquids and at least to some extent permeable to UV radiation is comprised of at least one ethylene homo- or copolymer and/or at least one propylene homo- or copolymer.

Claim 4: The insertion tube as claimed in claim 1, wherein the layers (c) and (e) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation have an identical layer structure, optionally an identical layer thickness, and/or identical polyamide components, and/or an identical composition, optionally an identical polyamide component.

Claim 5: The insertion tube as claimed in claim 1, wherein the layers (c) and (e) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation have a different layer structure, optionally a different layer thickness,

and/or different polyamide components, and/or a different composition.

- Claim 6: The insertion tube as claimed in claim 1, wherein the adhesive-promoter layers (b) and (d) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation comprise respectively mutually independently at least one modified thermoplastic olefin homo- or copolymer, optionally respectively mutually independently at least one modified thermoplastic ethylene homo- or copolymer and/or at least one modified propylene homo- or copolymer.
- Claim 7: The insertion tube as claimed in claim 1, wherein the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation consists of the layers (a)-(e).
- Claim 8: The insertion tube as claimed in claim 1, wherein the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation is permeable to an extent of at least 80% to UV radiation.
- Claim 9: The insertion tube as claimed in claim 1, wherein the surface layer (a) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation is directly adjacent to the support material.
- Claim 10: A pipe-renovation system suitable for the renovation of subterranean pipes, comprising an insertion tube as claimed in claim 1, provided for introduction into the pipe requiring renovation, and a source that emits UV radiation and/or short wave, visible light, and that is optionally moveable.

VIII. OVERVIEW OF THE PRIOR ART

A. European Publication No. EP0257742A2 to Glover

84. European Publication No. EP0267742 to Glover (“Glover”) is entitled “Multilayer Carrier Films.” Glover was filed on November 5, 1987 and published on May 18, 1988. EX1005 at p. 1.

85. The invention taught by Glover is described below:

The invention is concerned with a multilayer carrier film for supporting a fluid synthetic resin composition impregnated fibrous mat against a surface, for example the inside surface of a pipe, during the curing of the resin.

EX1005 at p. 1, Abstract.

86. The multilayer film taught by Glover comprises three main layers: an internal layer of polyamide (preferably nylon 6), with one external layer comprising a polyamide copolymer and the other external layer comprising “a weldable synthetic plastic composition.” EX1005 at p. 2, 2:15-23, *see also* EX1005 at p. 1, Abstract. This weldable synthetic plastic composition external layer may comprise the following polymers:

The weldable composition may be polyethylene, polypropylene, an ethylene/vinyl acetate copolymer, an ethylene/acrylic acid copolymer, an ethylene/ethyl acrylate copolymer, a polyurethane, a polycarbonate, or polyvinyl chloride.

EX1005 at p. 2, 2:35-39.

87. Glover further specifies that the external copolyamide layer must have a softening temperature below 170 °C, which allows it to be heat-bonded to the

fibrous mat used as the carrier material for the reactive resin. EX1005 at p. 3, 3:11-

19. The internal polyamide layer, generally having a higher softening point

compared to the copolyamide layer, has specific liquid impermeability properties:

The nylon layer is impermeable to the fluid synthetic resin composition and, as a consequence, there is no risk of the layer of the weldable synthetic plastic composition being attacked and swollen by the resin composition with the further risk of delamination.

EX1005 at p. 3, 3:3-8, *see also*, 3:8-11.

88. The multilayer film of Glover can be produced via lamination of the layers or by coextrusion. EX1005 at p. 3, 3:20-23. Additionally, to enhance the adhesion between the internal layer of polyamide and the external layers of copolyamide and weldable synthetic plastic composition, bonding layers of a bonding agent, such as polyethylene graft maleic anhydride copolymer, can be placed in between the internal layer and the external layers, resulting in the layer sequence detailed below:

External layer: weldable synthetic plastic composition

Internal layer: bonding layer

Internal layer: polyamide

Internal layer: bonding layer

External layer: polyamide copolymer

See, EX1005 at p. 3, 3:23-38.

89. The above-described multilayer film of Glover is heat-bonded to a fibrous mat via the copolyamide layer. EX1005 at p. 3, 3:11-17. The fibrous mat acts as a carrier material for a fluid synthetic resin composition. Further:

Since the multilayer film in accordance with the invention is resistant to delamination by the resin composition secured to it, elongated bags formed from the film in combination with a fibrous mat impregnated with resin may be made up conveniently in a factory, put into stock and taken to site to as required. This is considerably more convenient than having to apply the resin just before use of the combination such as on site to avoid possible delamination problems.

EX1005 at p. 4, 5:5-14.

90. The fluid synthetic resin may utilize either a light or heat activatable catalyst. EX1005 at p. 2, 2:46-50. In the case of a light activatable catalyst, the above-described multilayer film of Glover must transmit light. EX1005 at p. 4, 5:15-18.

91. The multilayer film of Glover initially is on the exterior of the CIPP liner, and acts as an elongated bag for convenient storing of the liner between manufacturing and installation. EX1005 at p. 4, 5:5-14. During installation, the CIPP liner of Glover is inverted into the host pipe, resulting in the multilayer film moving from the exterior to the interior of the insertion tube, where it holds the resin impregnated carrier material against the surface of the pipe and remains adhered to the resin impregnated carrier material. EX1005 at p. 2, 2:15-23.

B. U.S. Patent No. 6,679,966 to Brandenburger

92. U.S. Patent No. 6,679,966 (“Brandenburger”) is entitled “Liner with a Tubular Film that is Coated with a Nonwoven.” Brandenburger was filed on May 5, 2000 and was issued on January 20, 2004. EX1006 at p. 1.

93. Brandenburger discloses a liner for use in sewer pipe renovation:

The invention relates to a liner for producing a lining tube for carrying out sewer pipe renovation work, comprising at least one layer consisting of at least one tubular, resin impregnated fiber band and a tubular film located on said at least one fiber band. The aim of the invention is to improve a liner of this type. To the end, a plastic film used for producing the tubular film has a reinforcement in the form of a nonwoven layer on the side facing towards the resin impregnated fiber bands.

EX1006 at p. 1, Abstract.

94. Brandenburger teaches a tubular CIPP liner that utilizes an outer tubular film:

Furthermore, it is possible also that the reinforced tubular film is surrounded by a [sic] outer tubular film consisting of at least one plastic foil. Such an embodiment permits allocating defined properties to the tubular film materials used. The plastic foil employed for producing the reinforced tubular film may then have corresponding strength properties, whereas the plastic film used for making the outer tubular film may have advantageous properties such as, for example opaqueness, impermeability to resin etc. as well.

EX1006 at p. 3, 2:24-32, emphasis added.

95. Brandenburger further specifies that “[t]he outer tubular film can be produced from one or more plastic films,” and therefore can be single or multilayer. EX1006 at p. 5, 6:6-7. Figure 3 of Brandenburger Figure 2 below

shows this outer tubular film, “tubular film 11”, annotated in orange below, that “forms a protective outer layer.” EX1006 at p. 4, 4:35-38.

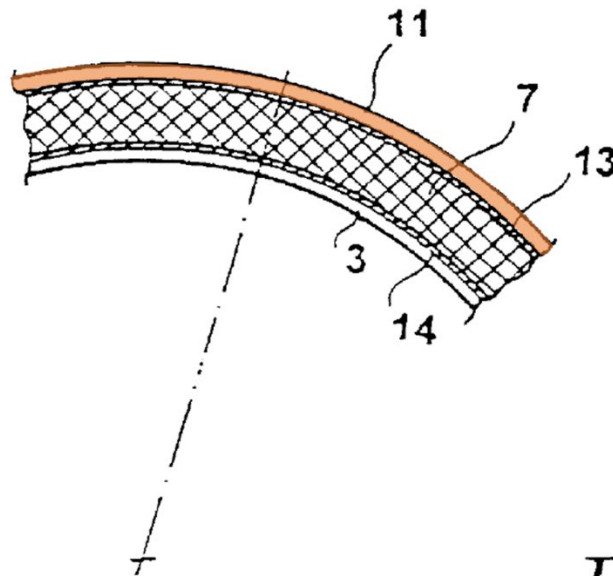


FIG. 2

Figure 3. Figure 2 of Brandenburger showing tubular film 11 acting as an externally situated single- or multilayer tubular film. EX1006 at p. 2, Figure 2.

C. Russian Patent No. RU2182999C1 to Khramenkov

96. Russian Patent No. RU2182999C1 (“Khramenkov”) is entitled “Method for Applying Hose Lining Onto Inner Surface of Pipeline and Applied Coating.” Khramenkov was filed on July 3, 2001 and published on May 27, 2002. EX1007 at p. 2.

97. Khramenkov teaches a CIPP liner:

This invention relates, generally, to building and construction, and more particularly, to a method for applying tubular lining onto the

inner surface of a pipeline and a lining of the inner surface of a pipeline obtained by this method, and can be used to protect the inner surface of a pipeline from mechanical damage, corrosion or unwanted deposits.

EX1007 at p. 4, 1:1-8.

98. Khramenkov further specifies that its CIPP liner comprises inner and outer tubular films with a tubular lining impregnated with a reactive resin:

To achieve this object, in the method for applying tubular lining onto the inner surface of a pipeline, comprising: placing reinforcing tubular lining impregnated with a curing bonding agent between inner and outer three-layer tubular films made of thermoplastic polymeric materials, outside a pipeline; inserting inner tubular film with reinforcing tubular lining in a pipeline and inflating inner tubular film by introducing pressurized air or water so that tubular lining contacts evenly with the inner surface of a pipeline and heat transfer medium with further heat treating until the bonding agent is cured, further removal of inner tubular film and providing a lining;

EX1007 at p. 5, 1:3-16.

99. The multilayer inner tubular film of Khramenkov comprises the following composition and layer structure:

Here, inner three-layer tubular film 4 has interconnected first outer layer 6 of polyamide 6 as a thermoplastic polymer material adjacent to the inner surface of reinforcing tubular lining 2 and capable of being split off from this tubular lining, second intermediate layer 7 in contact with outer layer 6 and comprising polyamide 12 or polyamide-based polymer adhesive as a thermoplastic material, and third inner layer 8 in contact with intermediate layer 7 and comprising a mixture of polyethylene with polypropylene as a thermoplastic polymer material, where one, polyethylene, may be molten when heated, and the other, polypropylene, is not molten and does not deteriorate, which contributes to the formation of a molten phase of a fusible polymer – polyethylene which is distributed among the defects of intermediate layer 7.

EX1007 at p. 6, 2:8-25, emphasis added.

100. The layer structure of the inner tubular film of Khramenkov is further demonstrated in Figure 4 below:

4 - Inner tubular film (6 + 7 + 8)

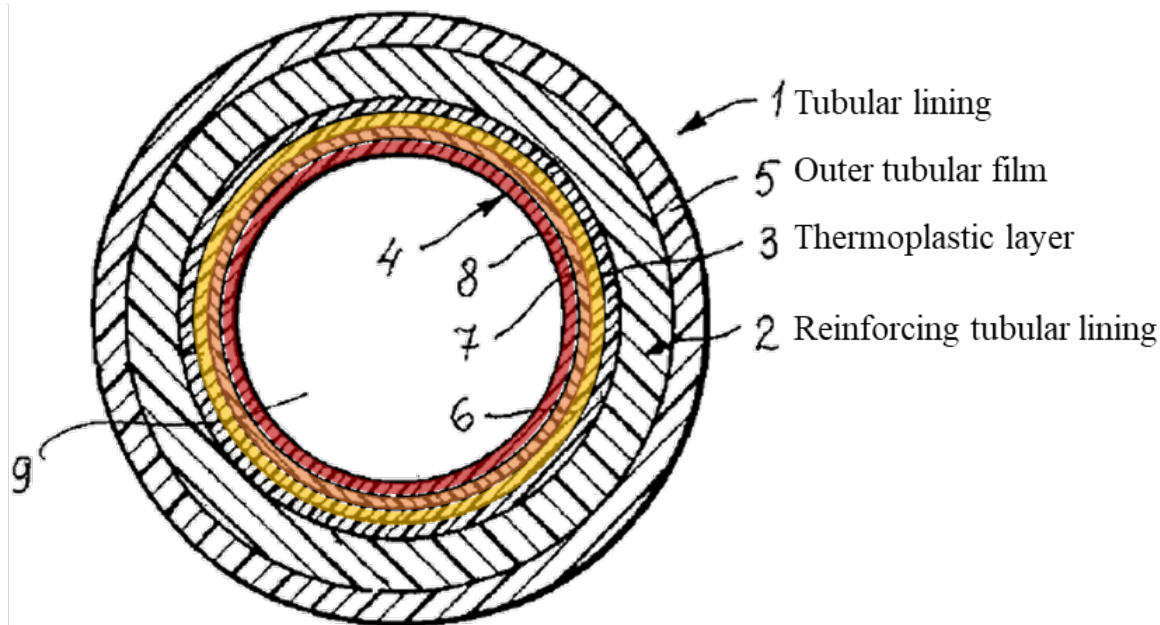


Fig. 1 6 - First outer layer of inner tubular film

7 - Second intermediate layer of inner tubular film

8 - Third inner layer of inner tubular film

Figure 4. Figure 1 of Khramenkov showing the layer structure of the inner tubular film 4 including thermoplastic layers 6, 7, and 8. EX1007 at p. 2, Fig. 1, annotations added.

101. Khramenkov further describes its outer tubular film:

Outer tubular film in contact with a defective pipeline prevents external intrusion of groundwater into uncured tubular lining and, thereby, protects it from washing out the uncured bonding agent; absorption of water prevents bonding agent from curing (water is an inhibitor of the curing process). The resulting thermoplastic coating in

contact with the transported liquid increases impermeability of a pipeline, improves its throughput, and prevents abrasive wear.

EX1007 at p. 6, 1:32-41.

102. The outer tubular film, item 5, is shown in Figure 5 below situated on the exterior of the CIPP liner:

4 - Inner tubular film (6 + 7 + 8)

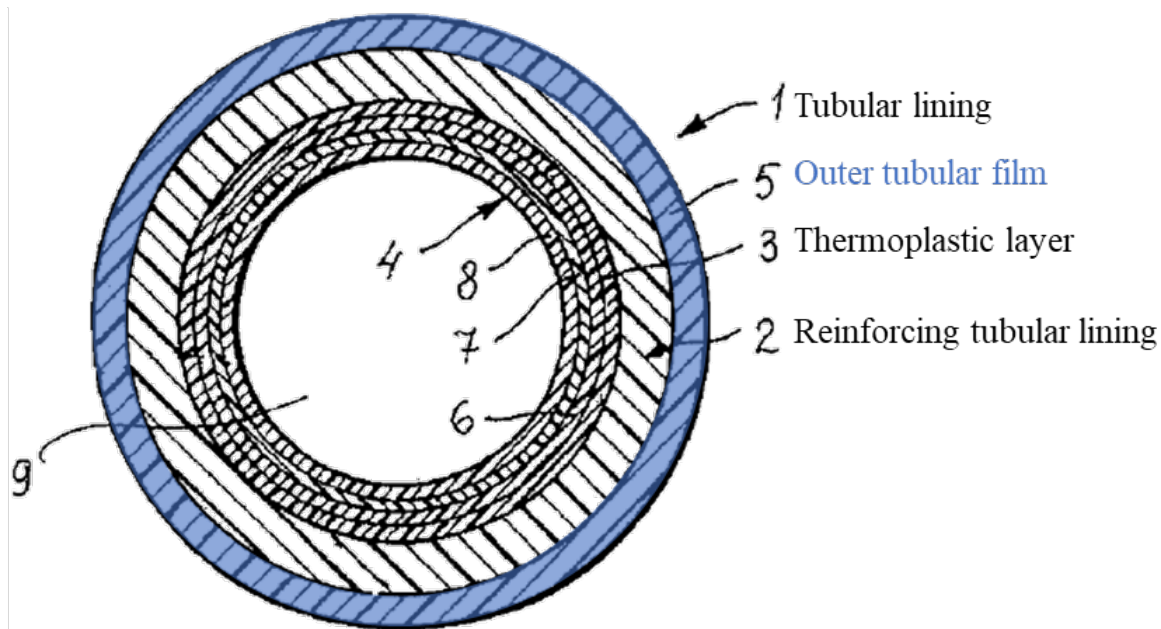


Fig. 1 6 - First outer layer of inner tubular film
7 - Second intermediate layer of inner tubular film
8 - Third inner layer of inner tubular film

Figure 5. Figure 1 of Khramenkov showing outer tubular film 5 situated on the exterior surface of Tubular lining 1. EX1007 at p. 2, Fig. 1, annotations added.

103. The CIPP liner taught by Khramenkov also includes a reinforcing tubular lining impregnated with a reactive resin. EX1007 at p. 5, 1:3-16, *see also* p. 7, 2:11-17. The inner surface of the reinforcing tubular lining (2, as shown below

in Figure 6) is formed from a thermoplastic layer (3, as shown below in Figure 6) that is strongly bonded to the reinforcing tubular lining. This forms an integral structure that makes up a support material that is impregnated with reactive resin. The curing method taught by Khramenkov is a heat-based curing mechanism. EX1007 at p. 5, 1:3-16. The support material impregnated with reactive resin is shown below in Figure 6 in relation to the inner tubular film and the outer tubular film:

4 - Inner tubular film (6 + 7 + 8)

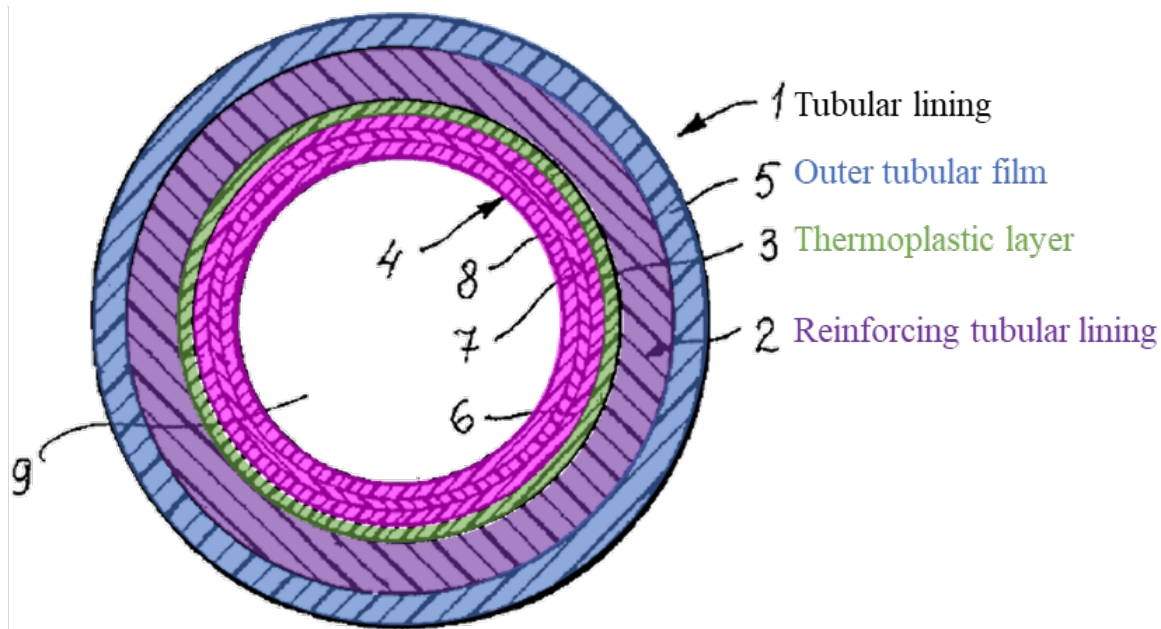


Fig. 1 6 - First outer layer of inner tubular film
 7 - Second intermediate layer of inner tubular film
 8 - Third inner layer of inner tubular film

Figure 6. Figure 1 of Khramenkov showing the reinforcing tubular lining 2 with a surface layer formed from thermoplastic layer 3 (*i.e.*, together forming the support material impregnated with reactive resin) situated between outer tubular film 5 and inner tubular film 4. EX1007 at p. 2, Fig. 1, annotations added.

104. Khramenkov further describes usage and the arrangement of the components of its CIPP liner:

The proposed method for applying tubular lining 1 (Fig. 1) onto the inner surface of a pipeline comprises the following: first, thermoplastic layer 3 strongly bonded to reinforcing tubular lining 2 being an internal surface of this tubular lining 2 made of synthetic polyester fiber felt and in contact with inner tubular film 4, is applied onto the surface of reinforcing tubular lining 2, and lateral end

portions of reinforcing tubular lining 2 with lateral end portions of thermoplastic layer 3 are interconnected, outside the pipeline.

EX1007 at p. 6, 1:52-63.

105. The arrangement of the Khramenkov CIPP liner components is shown below in Figure 7.

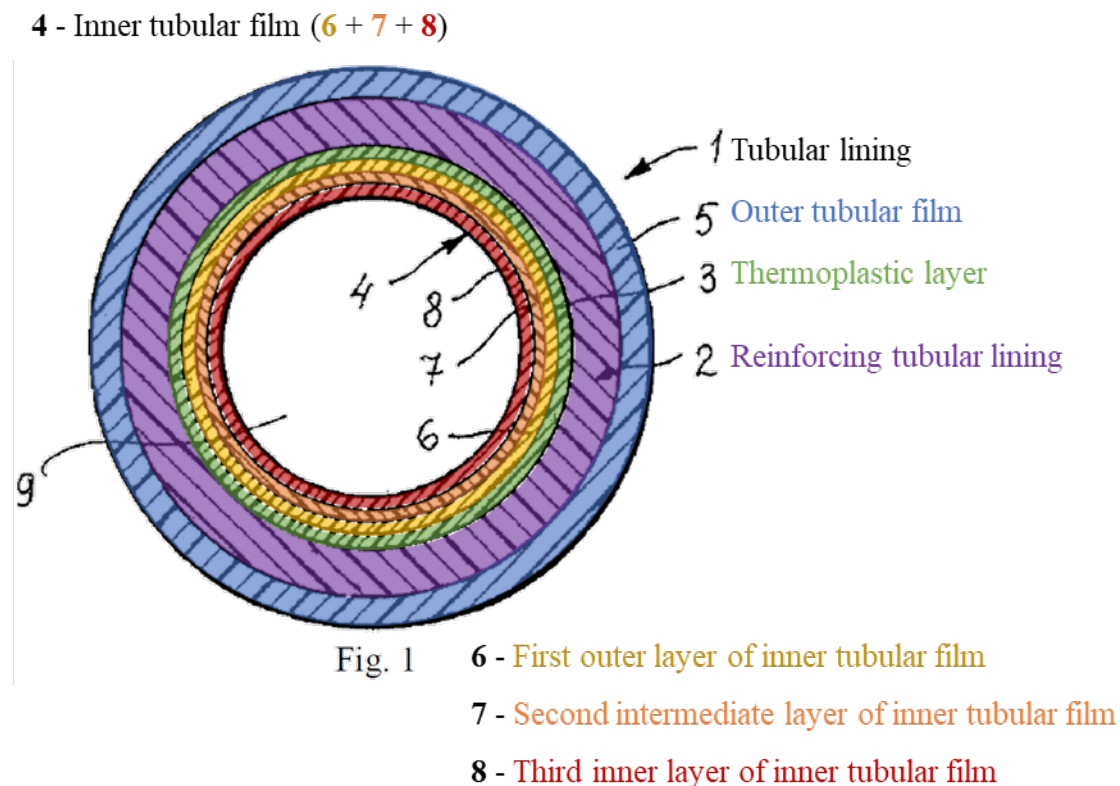


Figure 7. Figure 1 of Khramenkov showing components of its disclosed CIPP liner.

EX1007 at p. 2, Fig. 1, annotations added.

106. As shown in Figure 7, layer 6 of Khramenkov is directly adjacent to a thermoplastic layer 3 which is strongly bonded to the reinforcing tubular liner 2. Following installation and cure of the reactive resin impregnated in the reinforcing tubular lining, the inner tubular film is removed from the interior of the newly formed pipe. EX1007 at p. 6, 2:25-65.

D. European Publication No. EP0342897A2 to Jones

107. European Publication No. EP0342897A2 (“Jones”) is entitled “Polymeric Films.” It was filed on May 15, 1989 and published on November 23, 1989. EX1009 at p. 1.

108. Jones is directed towards the use of multilayer polymeric films in reconditioning sewer pipes:

It has been proposed to recondition pipes, for example sewer pipes, using an impermeable polymeric film securely attached to a fibrous mat, the mat being impregnated with a synthetic resin composition. The synthetic resin composition is cured in situ in the pipe while pressure is applied to the film to cause it to conform to the interior surface of the pipe.

109. EX1009 at p. 2, lns. 2-5.

110. The multilayer polymeric film of Jones has the following composition and layer sequence:

According to the present invention there is provided a multilayer polymeric film comprising a layer of a nylon polymer having a Vicat A (DIN 53460) softening point of not more than 170 °C and being substantially impermeable to styrene, and a layer of a weldable synthetic plastics composition bonded to the layer of the nylon polymer.

EX1009 at p. 2, lns. 14-17.

111. Jones further teaches that its multilayer film is impermeable to liquids due to the “good barrier properties” of the nylon layer:

Preferred nylon polymers for use in the present invention by virtue of their particularly good barrier properties to synthetic resin compositions conventionally used, and the good adhesion which they

exhibit to the weldable synthetic plastics composition, are those containing units from at least two and more preferably at least three nylon monomers.

EX1009 at p. 2, lns. 28-31.

112. Jones teaches the use of bonding layers between the layers of its multilayer film:

In a preferred embodiment of the invention, a bonding layer can be provided between the nylon polymer layer and the weldable synthetic plastics composition. The bonding layer can be a coextruded tie layer or a laminating adhesive, depending on the method used to manufacture films of the present invention. Suitable polymeric materials for use as the bonding layer include modified polyolefins, e.g. modified polyethylene or modified polypropylene, polyurethane, polymers containing units derived from ethylene and at least one of vinyl acetate, acrylic acid and lower C₁₋₄ alkyl acrylates, e.g. ethyl acrylate, and modified equivalents of such polymers, the modification in each case preferably being by the inclusion of units derived from maleic anhydride.

EX1009 at p. 2, lns. 42-49.

113. Jones also teaches that the reactive resin impregnated into the fibrous mat can be cured through heat or UV light. EX1009 at p. 2, lns. 7-9, *see also*, EX1009 at p. 3, lns. 26-28. In order for the light-activatable catalyst in the reactive resin to cure while the multilayer film applies pressure to the fibrous mat causing it to conform to the interior surface of the pipe, a POSITA would have understood that the multilayer film would need to be at least to some extent permeable to UV radiation.

IX. INVALIDITY OF THE '269 PATENT

A. Obviousness by Glover in view of Brandenburger

114. Glover in view of Brandenburger renders obvious claims 1-10 of the '269 Patent. European Publication No. EP0267742A2 to Glover ("Glover") was filed on November 5, 1987 and published on May 18, 1988, and I have been informed that it constitutes prior art. U.S. Patent No. 6,679,966 to Brandenburger ("Brandenburger") was filed on May 5, 2000 and issued on January 20, 2004, and I have been informed that it constitutes prior art. It would have been obvious for a POSITA to consider Glover and Brandenburger because these patents are directed to the same field of art, *i.e.*, CIPP technology, as the '269 Patent. Therefore, these references provide interrelated teachings and a POSITA would look to the concepts in Glover and Brandenburger when seeking to solve the problems purportedly addressed by the '269 Patent.

1. Claim 1

115. Glover in view of Brandenburger teaches all the limitations of Claim 1, as described below, and therefore renders obvious Claim 1.

a) Claim Element 1pre

An insertion tube suitable for the renovation of subterranean pipes, optionally subterranean sewer pipes, comprising

116. Glover teaches that:

The invention is concerned with a multilayer carrier film for supporting a fluid synthetic resin composition impregnated fibrous

mat against a surface, for example the inside surface of a pipe, during the curing of the resin.

EX1005 at p. 1, Abstract.

117. Therefore, Glover discloses “[a]n insertion tube suitable for the renovation of subterranean pipes, optionally subterranean sewer pipes” as set forth in the preamble of claim 1.

b) Claim Element 1A

an optionally nonconditioned multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation, comprising a layer sequence made of

118. Glover teaches a multilayer film and does not disclose a required conditioning step:

According to the present invention, a multilayer carrier film for supporting a fluid synthetic resin composition impregnated fibrous mat against a surface during the curing of the resin comprises a layer of a nylon which is impermeable to the resin composition having on one surface a layer of a polyamide copolymer having a softening point at a temperature below 170°C and on the other surface a layer of a weldable synthetic plastic composition.

EX1005 at p. 2, 2:15-23, emphasis added. *See also*, EX1005 at p. 3, 3:3-8.

119. Therefore, Glover teaches “an optionally nonconditioned multilayer film that is impermeable to liquids ...”.

120. Further, Glover teaches:

When the multilayer film in accordance with the invention transmits light, it can be used in circumstances where a light activatable curing catalyst is incorporated within the resin.

EX1005 at p. 4, 5:15-18, emphasis added.

121. The multilayer film of Glover comprises a layer sequence as described below in Sections IX.A.1.c) - IX.A.1.g). Therefore, Glover teaches “an optionally nonconditioned multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation, comprising a layer sequence...” and meets this limitation.

c) Claim Element 1A-1

a layer (a) comprised of at least one thermoplastic olefin homo- or copolymer, as one of the external layers,

122. Glover teaches:

According to the present invention, a multilayer carrier film for supporting a fluid synthetic resin composition impregnated fibrous mat against a surface during the curing of the resin comprises a layer of a nylon which is impermeable to the resin composition having on one surface a layer of a polyamide copolymer having a softening point at a temperature below 170°C and on the other surface a layer of a weldable synthetic plastic composition.

EX1005 at p. 2, 2:15-23, emphasis added.

123. Glover further describes that:

[t]he weldable composition may be polyethylene, polypropylene, an ethylene/vinyl acetate copolymer, an ethylene/acrylic acid copolymer, an ethylene/ethyl acrylate copolymer, a polyurethane, a polycarbonate, or polyvinyl chloride.

EX1005 at p. 2, 2:35-39.

124. Polyethylene and polypropylene are thermoplastic olefin homopolymers, as discussed above in Section VI.B. Therefore, Glover teaches “a

layer (a) comprised of at least one thermoplastic olefin homo- or copolymer, as one of the external layers” and meets this limitation.

d) Claim Element 1A-2

an adhesive-promoter layer (b),

125. Glover teaches a multilayer film with a layer sequence comprising an internal polyamide (*i.e.*, nylon) layer with a polyamide copolymer external layer and an additional external layer of “a weldable synthetic plastic composition.”

EX1005 at p. 2, 2:15-23. Glover further teaches:

Further, the adhesion of the nylon layer with either the copolymer layer or the layer of the weldable synthetic plastic composition, or both, may be enhanced by introducing between the layers a bonding layer of a bonding agent such as a polyethylene graft maleic anhydride copolymer.

EX1005 at p. 3, 3:23-28.

126. Accordingly, the multilayer sequence taught by Glover comprises:

External layer (a): weldable synthetic plastic composition

Internal layer (b): bonding layer

Internal layer (c): polyamide

Internal layer (d): bonding layer

External layer (e): polyamide copolymer

127. Therefore, Glover teaches “an adhesive-promoter layer (b)” and meets this limitation.

e) Claim Element 1A-3

an internally situated layer (c) comprised of at least one homo- and/or copolyamide,

128. Glover teaches:

According to the present invention, a multilayer carrier film for supporting a fluid synthetic resin composition impregnated fibrous mat against a surface during the curing of the resin comprises a layer of a nylon which is impermeable to the resin composition having on one surface a layer of a polyamide copolymer having a softening point at a temperature below 170°C and on the other surface a layer of a weldable synthetic plastic composition.

EX1005 at p. 2, 2:15-23, emphasis added.

129. As discussed above in Section VI.B, polyamides are also referred to as nylons. Further, as discussed above in Section IX.A.1.d), the multilayer sequence taught by Glover comprises:

External layer (a): weldable synthetic plastic composition

Internal layer (b): bonding layer

Internal layer (c): polyamide

Internal layer (d): bonding layer

External layer (e): polyamide copolymer

130. Therefore, Glover teaches “an internally situated layer (c) comprised of at least one homo- and/or copolyamide” and meets this limitation.

f) Claim Element 1A-4

an adhesive-promoter layer (d), and

131. Glover teaches a multilayer film with a layer sequence comprising an internal polyamide (*i.e.*, nylon) layer with a polyamide copolymer external layer and an additional external layer of “a weldable synthetic plastic composition.”

EX1005 at p. 2, 2:15-23. Glover further teaches:

Further, the adhesion of the nylon layer with either the copolymer layer or the layer of the weldable synthetic plastic composition, or both, may be enhanced by introducing between the layers a bonding layer of a bonding agent such as a polyethylene graft maleic anhydride copolymer.

EX1005 at p. 3, 3:23-28.

132. Accordingly, the multilayer sequence taught by Glover comprises:

External layer (a): weldable synthetic plastic composition

Internal layer (b): bonding layer

Internal layer (c): polyamide

Internal layer (d): bonding layer

External layer (e): polyamide copolymer

133. Therefore, Glover teaches “an adhesive-promoter layer (d)” and meets this limitation.

g) Claim Element 1A-5

a layer (e) comprised of at least one homo- and/or copolyamide, as one of the external layers,

134. Glover teaches:

According to the present invention, a multilayer carrier film for supporting a fluid synthetic resin composition impregnated fibrous mat against a surface during the curing of the resin comprises a layer

of a nylon which is impermeable to the resin composition having on one surface a layer of a polyamide copolymer having a softening point at a temperature below 170°C and on the other surface a layer of a weldable synthetic plastic composition.

EX1005 at p. 2, 2:15-23, emphasis added.

135. As discussed above in Section VI.B, polyamides are also referred to as nylons. Further, as discussed above in Section IX.A.1.d), the multilayer sequence taught by Glover comprises:

External layer (a): weldable synthetic plastic composition

Internal layer (b): bonding layer

Internal layer (c): polyamide

Internal layer (d): bonding layer

External layer (e): polyamide copolymer

136. Therefore, Glover teaches “a layer (e) comprised of at least one homo- and/or copolyamide, as one of the external layers” and meets this limitation.

h) Claim Element 1A-6

in the form of a tubular film,

137. Glover teaches that the multilayer film is in the form of an elongated bag. EX1005 at p. 2, 2:9-14. Glover teaches that:

Since the multilayer film in accordance with the invention is resistant to delamination by the resin composition secured to it, elongated bags formed from the film in combination with a fibrous mat impregnated with resin may be made up conveniently in a factory, put into stock and taken to site to as required.

EX1005 at p. 4, 5:5-11.

138. Therefore, Glover teaches a multilayer film “in the form of a tubular film” and meets this limitation.

i) Claim Element 1A-7

wherein the VICAT softening point of the thermoplastic olefin homo- or copolymer of the layer (a) is at least 100°C.;

139. While Glover discloses the softening temperature of the external copolyamide layer to be below 170 °C, Glover does not explicitly disclose the softening point of its weldable synthetic plastic composition external layer. EX1005 at p. 2, 2:15-23. As discussed above in Section VI.B, polyolefins, such as homopolymer polyethylene and homopolymer polypropylene, have a range of VICAT softening temperatures. Specifically, homopolymer polypropylene has a VICAT softening point in the range of 145-150 °C, while the VICAT softening point for homopolymer polyethylene has a softening point in the range of 85 to 130 °C, depending on the density. Low density polyethylene grades have a softening point in the range of 85-102 °C, while high density polyethylene grades have a softening point in the range of 120-130 °C.

140. However, Glover teaches that the resin system may utilize “either a heat activatable or a light activatable catalyst to bring about curing of the resin.” EX1005 at p. 2, 2:46-50. As discussed above in Section VI.A, heat-based curing can be accomplished through hot air or steam. A POSITA would have known that

these heat-based curing methods could easily reach elevated temperatures up to 100 °C. Therefore, a POSITA would have been motivated to try using a polyolefin, such as polypropylene or polyethylene as disclosed by Glover, with a VICAT softening point of at least 100 °C to ensure the inner tubular film would be able to withstand the anticipated temperatures associated with a heat-based curing process. Of the polyolefins taught by Glover, a POSITA would have known to select a polypropylene or a polyethylene material with a VICAT softening temperature above 100 °C to withstand the known heat-based curing conditions.

141. Therefore, Glover teaches a multilayer film “wherein the VICAT softening point of the thermoplastic olefin homo- or copolymer of the layer (a) is at least 100°C” and meets this limitation.

j) Claim Element 1A-8

as internally situated tube, and

142. The disclosed invention of Glover seeks to allow insertion tubes used for pipe renovation to be manufactured and then “stored for convenient periods before use in reconditioning pipes.” EX1005 at 2, 2:9-14. Glover achieves this goal through the composition of its multilayer film that resists attack from the resin which would result in the delamination of the film from the resin impregnated carrier material. EX1005, p. 2, 1:51-2:14, p. 4, 5:5-11. The multilayer film of Glover is initially on the exterior of the carrier material but is inserted into the host

pipe through inversion. This inversion process, discussed above in Section VI.A, results in the multilayer film moving from the exterior to the interior of the insertion tube, where it holds the resin impregnated carrier material against the surface of the pipe and remains adhered to the resin impregnated carrier material. EX1005 at p. 2, 2:15-23, *see also*, p. 4, 5:5-14.

143. Therefore, Glover discloses a multilayer film “as internally situated tube” and meets this limitation.

k) Claim Element 1B

an externally situated single- or multilayer tubular film which is impermeable to liquids, and which reflects and/or absorbs UV radiation and/or short-wave, visible light, as externally situated tube, and

144. Brandenburger teaches a tubular CIPP liner that utilizes an outer tubular film:

Furthermore, it is possible also that the reinforced tubular film is surrounded by a [sic] outer tubular film consisting of at least one plastic foil. Such an embodiment permits allocating defined properties to the tubular film materials used. The plastic foil employed for producing the reinforced tubular film may then have corresponding strength properties, whereas the plastic film used for making the outer tubular film may have advantageous properties such as, for example opaqueness, impermeability to resin etc. as well.

EX1006 at p. 3, 2:24-32, emphasis added.

145. Brandenburger further specifies that “[t]he outer tubular film can be produced from one or more plastic films,” and therefore can be single or multilayer. EX1006 at p. 5, 6:6-7. The outer tubular film according to

Brandenburger can be made using polyethylene. EX1006 at p. 3, 2:42-45. Figure 2 of Brandenburger shows this outer tubular film, “tubular film 11”, annotated in orange below, that “forms a protective outer layer,” as shown below in Figure 8. EX1006 at p. 4, 4:35-38.

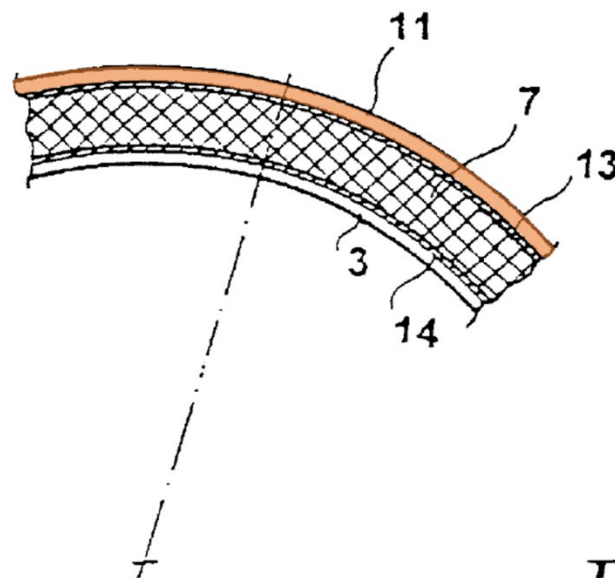


FIG.2

Figure 8. Figure 2 of Brandenburger showing tubular film 11 acting as an externally situated single- or multilayer tubular film. EX1006 at p. 2, Figure 2.

146. Therefore, Brandenburger teaches “externally situated single- or multilayer tubular film which is impermeable to liquids, and which reflects and/or absorbs UV radiation and/or short-wave, visible light, as externally situated tube.”

147. It would have been obvious to a POSITA to combine the externally situated tube of Brandenburger with the multilayer film and resin impregnated

carrier material of Glover, as both Brandenburger and Glover teach the use of insertion tubes for pipe renovation. EX1005 at p. 1, EX1006 at p. 1 The disclosed invention of Glover seeks to allow insertion tubes used for pipe renovation to be manufactured and then “stored for convenient periods before use in reconditioning pipes.” EX1005 at 2, 2:9-14. Glover achieves this goal through the composition of its multilayer film that resists attack from the resin which would result in the delamination of the film from the resin impregnated carrier material. EX1005, p. 2, 1:51-2:14, p. 4, 5:5-11. The multilayer film of Glover is initially on the exterior of the carrier material but is inserted into the host pipe through inversion. This inversion process, discussed above in Section VI.A, results in the multilayer film moving from the exterior to the interior of the insertion tube, where it holds the resin impregnated carrier material against the surface of the pipe and remains adhered to the resin impregnated carrier material. EX1005 at p. 2, 2:15-23, *see also*, p. 4, 5:5-14.

148. Glover contemplates that the resin used to impregnate the carrier material can be cured using UV light or through heat. EX1005 at p. 2, 2:46-50. Therefore, when using a UV light activated catalyst in the curable resin, the insertion tube must be stored without exposure to UV light, as the multilayer film of Glover (which is initially on the outside of the insertion tube) must transmit

light to facilitate the cure of resin during installation of the insertion tube. EX1005 at p. 3, 4:20-22, p. 4, 5:15-18.

149. A POSITA contemplating Glover would have been motivated to further improve the ease of storage for its insertion tube through the use of an externally situated tubular film that reflects and/or absorbs UV radiation and/or short-wave, visible light and is impermeable to liquids. By combining the external tubular film of Brandenburger with the insertion tube of Glover, the insertion tube of Glover would no longer be required to be stored in dark conditions and would be generally protected from premature curing. This invention would comprise the external tubular film of Brandenburger with the multilayer tubular film of Glover as an inner tubular film, with the resin impregnated carrier material of Glover situated there between. This insertion tube would be inserted into the host pipe through the pull-in method, discussed above in Section VI.A.

150. Therefore, Glover in view of Brandenburger teaches “an externally situated single- or multilayer tubular film which is impermeable to liquids, and which reflects and/or absorbs UV radiation and/or short-wave, visible light, as externally situated tube” and meets this limitation.

I) Claim Element 1C

a support material situated therebetween and saturated with a reactive synthetic resin.

151. As discussed above in Section IX.A.1.k), a POSITA would have been motivated to combine the support material and multilayer film of Glover with the external tubular film of Brandenburger to improve the ease of storage and deter the premature curing of the insertion tube. The multilayer film of Glover is bonded to the resin impregnated support material and situated on the interior of the insertion tube. EX1005 at p. 3, 4:4-9. The resin system taught by Glover may utilize “either a heat activatable or a light activatable catalyst to bring about curing of the resin.” EX1005 at p. 2, 2:46-50. The external tubular film of Brandenburger is applied on the other side of the support material, such that the resin impregnated support material is situated between the inner tubular film and the external tubular film. Therefore, Glover in view of Brandenburger teaches “a support material situated therebetween and saturated with a reactive synthetic resin” and meets this limitation.

152. For at least the reasons described above, Glover in view of Brandenburger renders obvious Claim 1.

2. Claim 2

The insertion tube as claimed in claim 1, wherein the thickness of the layer (a) is at least 40% of the total thickness of the multilayer film that is impermeable to liquids and at least to some extent permeable to UV radiation.

153. As discussed above, Glover in view of Brandenburger renders obvious Claim 1, from which Claim 2 depends. Further, Glover discloses several example

embodiments of the multilayer film. Specifically, example embodiment 1 of Glover is described below:

Three separate molten streams of nylon 6, a polyethylene ionomer based upon zinc ions (“Surlyn”) and a polyamide copolymer consisting of 49% nylon 6 and 51% nylon 12 by weight were coextruded through a slot die with the nylon 6 stream as the middle component.

EX1005 at p. 3, 3:50-55.

154. Example embodiment 3 and 4 of Glover further build upon example embodiment 1:

The procedure of Example 1 was further repeated (Example 3) except that a different polyamide copolymer was used and a change was made in the thickness of the polyethylene ionomer layer.

The procedure of Example 3 was repeated (Example 4) except that a polyethylene graft maleic anhydride copolymer was co-extruded with the other layers between the nylon 6 and the polyethylene ionomer.

EX1005 at p. 3, 4:43-52.

155. The thicknesses for the layers of example embodiment 4 of Glover are:

Polyamide copolymer (60% nylon 6 and 40% nylon 12): 30 μm

Nylon 6: 30 μm

Polyethylene graft maleic anhydride copolymer: 10 μm

Polyethylene ionomer “Surlyn”: 190 μm

EX1005 at p. 5, *see also*, p. 3, 3:50-55, 4:43-52

156. While example embodiment 4 only includes one adhesion promoter layer (*i.e.*, the polyethylene graft maleic anhydride copolymer), Glover discloses that multiple adhesion promoter layers can be used, as shown below and discussed above in Sections IX.A.1.d) and IX.A.1.f):

Further, the adhesion of the nylon layer with either the copolymer layer or the layer of the weldable synthetic plastic composition, or both, may be enhanced by introducing between the layers a bonding layer of a bonding agent such as a polyethylene graft maleic anhydride copolymer.

EX1005 at p. 3, 3:23-28, emphasis added.

157. Therefore, a possible embodiment including two adhesion promoter layers as taught by Glover based on example embodiment number 4 could have the following layer stack up:

External layer (a): weldable synthetic plastic composition, **190 μm**

Internal layer (b): Polyethylene graft maleic anhydride copolymer, **10 μm**

Internal layer (c): Nylon 6, **30 μm**

Internal layer (d): Polyethylene graft maleic anhydride copolymer, **10 μm**

External layer (e): Polyamide copolymer (60% nylon 6 and 40% nylon 12), **30 μm**

EX1005 at p. 5.

158. The total film thickness of the above embodiment is 270 μm . Layer (a), with a layer thickness of 190 μm , comprises over 70% of the total film thickness.

159. Therefore, Glover in view of Brandenburger teaches a multilayer film “wherein the thickness of the layer (a) is at least 40% of the total thickness of the multilayer film that is impermeable to liquids and at least to some extent permeable to UV radiation” and therefore renders obvious Claim 2.

3. Claim 3

[3a] The insertion tube as claimed in claim 1, wherein the layer (a) of the multilayer film that is impermeable to liquids and at least to some extent permeable to UV radiation is comprised of

[3b] at least one ethylene homo- or copolymer and/or

[3c] at least one propylene homo- or copolymer.

160. Claim elements [3b] and [3c] are stated in the disjunctive “or” meaning either [3b] or [3c] can be true or both; *i.e.*, if [3a] and either [3b] or [3c] are found in Glover in view of Brandenburger, then the limitations of this claim are met.

161. As discussed above, Glover in view of Brandenburger renders obvious Claim 1, from which Claim 3 depends. Glover discloses that:

[t]he weldable composition may be polyethylene, polypropylene, an ethylene/vinyl acetate copolymer, an ethylene/acrylic acid copolymer, an ethylene/ethyl acrylate copolymer, a polyurethane, a polycarbonate, or polyvinyl chloride.

EX1005 at p. 2, 2:35-39.

162. As shown above, Glover discloses that layer (a) (*i.e.*, the weldable composition layer) can comprise “polyethylene,” an ethylene homopolymer, or “an

ethylene/vinyl acetate copolymer, an ethylene/acrylic acid copolymer, an ethylene/ethyl acrylate copolymer” which are all ethylene copolymers. Glover further discloses that layer (a) can comprise “polypropylene,” a propylene homopolymer. Therefore, Glover in view of Brandenburger teach all limitations of Claim 3, specifically:

[3a] The insertion tube as claimed in claim 1, wherein the layer (a) of the multilayer film that is impermeable to liquids and at least to some extent permeable to UV radiation is comprised of

[3b] at least one ethylene homo- or copolymer and/or

[3c] at least one propylene homo- or copolymer.

163. For at least these reasons, Glover in view of Brandenburger renders obvious Claim 3.

4. Claim 4

[4a] The insertion tube as claimed in claim 1, wherein the layers (c) and (e) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation have an identical layer structure, optionally

[4b] an identical layer thickness, and/or

[4c] identical polyamide components, and/or

[4d] an identical composition, optionally an identical polyamide component.

164. Claim elements [4b], [4c] and [4d] are stated in the disjunctive “or” meaning either [4b], [4c] or [4d] can be true or more than one can; *i.e.*, if either

[4b], [4c] or [4d] is found in Glover in view of Brandenburger, then the limitations of this claim are met.

165. As discussed above, Glover in view of Brandenburger renders obvious Claim 1, from which Claim 4 depends. Glover describes the external layer (layer (e)) as comprising a “polyamide copolymer” and layer (c) as “a layer of nylon.” EX1005 at p. 2, 2:15-23. Further, Glover describes an embodiment, Example 1:

Three separate molten streams of nylon 6, a polyethylene ionomer based upon zinc ions ("Surlyn") and a polyamide copolymer consisting of 49% nylon 6 and 51% nylon 12 by weight were coextruded through a slot die with the nylon 6 stream as the middle component.

The combination was cast onto a chill roll to form a multilayer film. The size of the die and processing parameters were so arranged that in the final film the thickness of the layers were polyamide copolymer - 30 microns, nylon 6 – 30 microns and polyethylene ionomer - 150 microns.

EX1005 at p. 3, 3:50-4:3.

166. In Example 1, the external layer (e), comprising a “polyamide copolymer,” and internal layer (c), comprising “nylon 6,” are both 30 μm in thickness.

167. Therefore, Glover in view of Brandenburger teaches the limitations of Claim 4, specifically:

[4a] The insertion tube as claimed in claim 1, wherein the layers (c) and (e) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation have an identical layer structure, optionally

[4b] an identical layer thickness,

168. For at least these reasons, Glover in view of Brandenburger renders obvious Claim 4.

5. Claim 5

[5a] The insertion tube as claimed in claim 1, wherein the layers (c) and (e) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation have a different layer structure, optionally

[5b] a different layer thickness, and/or

[5c] different polyamide components, and/or

[5d] a different composition.

169. Claim elements [5b], [5c] and [5d] are stated in the disjunctive “or” meaning either [5b], [5c] or [5d] can be true or more than one can; *i.e.*, if either [5b], [5c] or [5d] is found in Glover in view of Brandenburger, then the limitations of this claim are met.

170. As discussed above, Glover in view of Brandenburger renders obvious Claim 1, from which Claim 5 depends. Glover describes the external layer (layer (e)) as comprising a “polyamide copolymer” and layer (c) as “a layer of nylon.” EX1005 at p. 2, 2:15-23. Further, Glover describes an embodiment, Example 1:

Three separate molten streams of nylon 6, a polyethylene ionomer based upon zinc ions (“Surlyn”) and a polyamide copolymer consisting of 49% nylon 6 and 51% nylon 12 by weight were coextruded through a slot die with the nylon 6 stream as the middle component.

The combination was cast onto a chill roll to form a multilayer film. The size of the die and processing parameters were so arranged that in the final film the thickness of the layers were polyamide copolymer - 30 microns, nylon 6 – 30 microns and polyethylene ionomer - 150 microns.

EX1005 at p. 3, 3:50-4:3.

171. In Example 1, the external layer (e) comprises “a polyamide copolymer consisting of 49% nylon 6 and 51% nylon 12” while layer (c), the middle component, comprises nylon 6. Therefore, layer (c) and layer (e) have different polyamide components (*e.g.*, nylon 6 in layer (c) vs. nylon 6 and nylon 12 copolyamide in layer (e)) and different compositions (*e.g.*, 100% nylon 6 in layer (c) vs. a copolyamide consisting of 49% nylon 6 and 51% nylon 12 in layer (e)).

172. Therefore, Glover in view of Brandenburger teaches the limitations of Claim 5, specifically:

[5a] The insertion tube as claimed in claim 1, wherein the layers (c) and (e) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation have a different layer structure, optionally

[5c] different polyamide components, and/or

[5d] a different composition.

173. For at least these reasons, Glover in view of Brandenburger renders obvious Claim 5.

6. Claim 6

The insertion tube as claimed in claim 1, wherein the adhesive-promoter layers (b) and (d) of the multilayer film that is

impermeable to liquids and that is at least to some extent permeable to UV radiation comprise respectively mutually independently at least one modified thermoplastic olefin homo- or copolymer, optionally respectively mutually independently at least one modified thermoplastic ethylene homo- or copolymer and/or at least one modified propylene homo- or copolymer.

174. As discussed above, Glover in view of Brandenburger renders obvious Claim 1, from which Claim 6 depends. Glover describes the adhesive-promoter layers (b) and (d) of the multilayer film:

Further, the adhesion of the nylon layer with either the copolymer layer or the layer of the weldable synthetic plastic composition, or both, may be enhanced by introducing between the layers a bonding layer of a bonding agent such as a polyethylene graft maleic anhydride copolymer.

EX1005 at p. 3, 3:23-28, emphasis added.

175. A polyethylene graft maleic anhydride copolymer is an example of a modified thermoplastic ethylene copolymer, as discussed in Section VI.B. Therefore, Glover in view of Brandenburger teaches a multilayer film “wherein the adhesive-promoter layers (b) and (d) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation comprise respectively mutually independently at least one modified thermoplastic olefin homo- or copolymer, optionally respectively mutually independently at least one modified thermoplastic ethylene homo- or copolymer and/or at least one modified propylene homo- or copolymer” and therefore renders obvious Claim 6.

7. Claim 7

The insertion tube as claimed in claim 1, wherein the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation consists of the layers (a)-(e).

176. As discussed above, Glover in view of Brandenburger renders obvious Claim 1, from which Claim 7 depends. As discussed above in Section IX.A.1 with respect to Claim 1, Glover teaches a multilayer film with a layer sequence comprising an internal polyamide (*i.e.*, nylon) layer with a polyamide copolymer external layer and an additional external layer of “a weldable synthetic plastic composition.” EX1005 at p. 2, 2:15-23. The weldable composition may comprise various olefins, including polyethylene and polypropylene. EX1005 at p. 2, 2:35-39. Glover further teaches:

Further, the adhesion of the nylon layer with either the copolymer layer or the layer of the weldable synthetic plastic composition, or both, may be enhanced by introducing between the layers a bonding layer of a bonding agent such as a polyethylene graft maleic anhydride copolymer.

EX1005 at p. 3, 3:23-28.

177. Accordingly, the multilayer sequence taught by Glover comprises:

External layer (a): weldable synthetic plastic composition

Internal layer (b): bonding layer

Internal layer (c): polyamide

Internal layer (d): bonding layer

External layer (e): polyamide copolymer

178. Therefore, Glover in view of Brandenburger teaches “wherein the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation consists of the layers (a)-(e)” and therefore renders obvious Claim 7.

8. Claim 8

The insertion tube as claimed in claim 1, wherein the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation is permeable to an extent of at least 80% to UV radiation.

179. As discussed above, Glover in view of Brandenburger renders obvious Claim 1, from which Claim 8 depends. While Glover does not disclose the extent of permeability of the multilayer film to UV radiation, a POSITA would have understood that in order for efficient UV curing of the reactive synthetic resin to occur, the internally situated multilayer film would need to be at least 80% permeable to UV radiation. Further, a POSITA would have been motivated to utilize a multilayer film with as high of a permeability to UV radiation as possible for the internally situated multilayer film to facilitate efficient UV curing of the reactive synthetic resin. As discussed above in Section VI.C, while optical properties will vary with polymer chemical composition, blend, and density, polyolefin- and polyamide-based films can achieve UV radiation transmission of greater than 80% within the UV spectrum. Further, as discussed above in Section VI.A, UV curing has been used in CIPP liners since the early 2000s. All inner

tubular films used in UV curable CIPP liners since its use would have been required to a high level of UV radiation in order to cure efficiently. Therefore, Glover teaches an insertion tube “wherein the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation is permeable to an extent of at least 80% to UV radiation.”

180. For at least these reasons, Glover in view of Brandenburger renders obvious Claim 8.

9. Claim 9

The insertion tube as claimed in claim 1, wherein the surface layer (a) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation is directly adjacent to the support material.

181. As discussed above, Glover in view of Brandenburger renders obvious Claim 1, from which Claim 9 depends. As discussed above in Section IX.A.1.c), layer (a) of Glover comprises at least one thermoplastic olefin, such as polypropylene or polyethylene. EX1005 at p. 2, 2:35-39. Glover teaches that the nylon copolymer layer (*i.e.*, layer (e)) is directly adjacent to the support material and is heat-bonded to the mat. EX1005 at p. 3, 3:11-19. However, a POSITA considering Glover in view of Brandenburger would have found it obvious to try flipping the multilayer film taught by Glover to have external layer (a), comprising at least one thermoplastic olefin, adjacent to the support material and layer (e), comprising a copolyamide, facing the interior of the CIPP liner.

182. Both Glover and Brandenburger are directed at preventing the delamination of inner and/or outer films from the carrier material. EX1005 at p. 1, Abstract, p. 4, 5:5-14, EX1006 at p. 3, 1:26-36. The one other available arrangement of the multilayer inner tubular film not disclosed by Glover (*i.e.*, with the external layer (a) comprising an olefin against the carrier material) would have been obvious to a POSITA when considering Glover because the use of an olefin-based surface against a carrier material would have had the predictable solution of forming a good bond with the carrier material and not delaminating from the CIPP liner. A POSITA would have had a reasonable expectation of success with this configuration change as a POSITA would have known that polyolefins, such as polypropylene and polyethylene, were known for having good chemical stability, as discussed above in Section VI.B.

183. While Glover states that the internal nylon layer (c) prevents the weldable synthetic plastic composition (layer (a)) from “being attacked and swollen by the resin composition” (EX1005 at p. 3, 3:3-8), a POSITA contemplating Glover in view of Brandenburger would understand that polyolefins can form successful bonds with a fleece or fabric material impregnated with reactive resin. Glover was filed on November 5, 1987 and published on May 18, 1988, while Brandenburger is a more contemporary patent, that was filed on May 5, 2000 and was issued on January 20, 2004. A POSITA contemplating

Brandenburger would have understood that advances in polyolefin materials between the filing of Glover and Brandenburger would allow polyolefins to withstand exposure to reactive resins without risk of swelling or delamination.

184. For example, Brandenburger teaches that its outer tubular film is preferably formed from polyethylene. EX1006 at p. 3, 2:42-45. The outer tubular film 11 (formed from band material 8) of Brandenburger comes directly into contact with the reactive resin:

The band material 8 is a plastic film made of polyethylene, which is finally wound onto the resin-impregnated glass fiber fabric, so that a tubular film 11 forms a protective outer layer.

...

The inner surface 12 of the plastic film 8 is laminated with a reinforcement in the form of a fleece layer 13. The laminating process is preferably carried out by partially melting the plastic film 8, so that the polyester fleece is partly embedded in the surface 12 of the plastic film 8. The fleece has a thickness of 60 µm and a weight of 30 grams per square meter. The fleece layer 13 is thoroughly impregnated with the resin, so that an intimate bond is produced between the fiber bands 7 and the plastic film 8 even in the uncured condition.

EX1006 at p. 4, 4:33-37, 4:42-51, emphasis added.

185. Brandenburger further teaches that the reactive resin that “thoroughly” impregnates the fleece layer 13 and produces an “intimate bond” with the outer tubular film, does not cause delamination of the fleece layer 13 from the outer tubular film 11:

Furthermore, the advantage offered by a plastic film laminated with a layer of fleece consists in that the plastic film and the layer of fleece

will not lose their tendency to bond to each other even in the course of longer storage...

EX1006 at p. 4, 4:60-63.

186. As described above in Section IX.A.1.k), a POSITA would have been motivated to combine the externally situated tube of Brandenburger with the multilayer film and resin impregnated carrier material of Glover. A POSITA would have known that the outer tubular film of Brandenburger, comprising polyethylene, would be able to be directly adjacent to the resin impregnated support material without risk of swelling or delamination for at least the reasons described above.

187. Further, Glover notes that:

The nylon layer, however, has a relatively high softening point which makes it impracticable to heat weld it to a mat of synthetic plastics fibres.

EX1005 at p. 3, 3:8-11.

188. As discussed above in Section IX.A.1.i), a POSITA would have been motivated to use an olefin with a VICAT softening point of at least 100 °C for the external layer (a). A POSITA would have known that the VICAT softening point of olefins are generally lower than polyamides, and similar to the copolyamides described by Glover. EX1005 at p. 3, 3:11:19, *see also*, Section VI.B. Therefore, a POSITA would have found that changing the orientation of the multilayer film of Glover to have the olefin layer (a) against the carrier material would result in the predictable solution of achieving a good bond via heat-bonding between the carrier

material and the olefin layer (a) with a reasonable expectation of success. Further, a POSITA would not have been concerned that the reactive resin would cause any risk of delamination of the olefin layer (a) and the carrier material, as Brandenburger demonstrated that the polyethylene-based outer tubular film laminated to a fleece layer would “not lose their tendency to bond to each other even in the course of longer storage” with reactive resin thoroughly impregnated into the fleece layer in direct contact with the outer tubular film. EX1006 at p. 4, 4:42-51, 4:60-63.

189. Further, a POSITA would have known that polyolefins are known for their flexibility and elasticity and are generally less stiff than polyamides. *See* Section VI.B. A POSITA would have known that having layer (a) comprising an olefin against the carrier material would allow the inner tubular film to stretch more with the carrier material to urge the carrier material against the inside surface of the host pipe during inflation of the CIPP liner during installation without delaminating from the carrier.

190. Therefore, Glover in view of Brandenburger teaches a multilayer film “wherein the surface layer (a) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation is directly adjacent to the support material” and therefore renders obvious Claim 9.

10. Claim 10

A pipe-renovation system suitable for the renovation of subterranean pipes, comprising an insertion tube as claimed in claim 1, provided for introduction into the pipe requiring renovation, and a source that emits UV radiation and/or short wave, visible light, and that is optionally moveable.

191. As discussed above, Glover in view of Brandenburger renders obvious Claim 1, from which Claim 10 depends. Glover teaches that:

The invention is concerned with a multilayer carrier film for supporting a fluid synthetic resin composition impregnated fibrous mat against a surface, for example the inside surface of a pipe, during the curing of the resin.

EX1005 at p. 1, Abstract.

192. Therefore, Glover teaches an insertion tube “provided for introduction into the pipe requiring renovation.”

193. Further, Glover teaches that the resin system may utilize “either a heat activatable or a light activatable catalyst to bring about curing of the resin” and further requires that the inner tubular film “transmits light” to facilitate curing when a light activatable catalyst is utilized. EX1005 at p. 2, 2:46-50, p. 4, 5:15-18. Therefore, while Glover does not explicitly disclose the use of “a source that emits UV radiation and/or short wave, visible light, and that is optionally moveable” a POSITA would have understood that the use of such a light source would be required to activate the “light activatable catalyst” used in the reactive resin to efficiently cure the CIPP liner of Glover. For example, as discussed above in

Section VI.A, UV light trains were well known light sources that move through inflated CIPP liners during installation to cure the reactive resin. Therefore, Glover discloses “a source that emits UV radiation and/or short wave, visible light, and that is optionally moveable.”

194. Glover in view of Brandenburger therefore teaches an insertion tube “for introduction into the pipe requiring renovation, and a source that emits UV radiation and/or short wave, visible light, and that is optionally moveable” and renders obvious Claim 10.

B. Obviousness by Khramenkov in view of Jones

195. Khramenkov in view of Jones renders obvious claims 1-10 of the '269 Patent. Russian Patent No. RU2182999C1 (“Khramenkov”) was filed on July 3, 2001 and published on May 27, 2002, and I have been informed that it constitutes prior art. European Publication No. EP0342897A2 (“Jones”) was filed on May 15, 1989 and published on November 23, 1989, and I have been informed that it constitutes prior art. It would have been obvious for a POSITA to consider Khramenkov and Jones because these patents are directed to the same field of art, *i.e.*, CIPP technology, as the '269 Patent. Therefore, these references provide interrelated teachings and a POSITA would have looked to the concepts in Khramenkov and Jones when seeking to solve the problems purportedly addressed by the '269 Patent.

1. Claim 1

196. Khramenkov in view of Jones teaches all the limitations of Claim 1, as described below, and therefore renders obvious Claim 1.

a) Claim 1pre

An insertion tube suitable for the renovation of subterranean pipes, optionally subterranean sewer pipes, comprising

197. Khramenkov teaches:

This invention relates, generally, to building and construction, and more particularly, to a method for applying tubular lining onto the inner surface of a pipeline and a lining of the inner surface of a pipeline obtained by this method, and can be used to protect the inner surface of a pipeline from mechanical damage, corrosion or unwanted deposits.

EX1007 at p. 4, 1:1-8.

198. Therefore, Khramenkov discloses “an insertion tube suitable for the renovation of subterranean pipes, optionally subterranean sewer pipes” as set forth in the preamble of claim 1.

b) Claim Element 1A

An optionally nonconditioned multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation, comprising a layer sequence made of

199. Khramenkov teaches a multilayer film and does not disclose a required conditioning step:

To achieve this object, in the method for applying tubular lining onto the inner surface of a pipeline, comprising: placing reinforcing tubular lining impregnated with a curing bonding agent between inner and

outer three-layer tubular films made of thermoplastic polymeric materials, outside a pipeline; inserting inner tubular film with reinforcing tubular lining in a pipeline and inflating inner tubular film by introducing pressurized air or water so that tubular lining contacts evenly with the inner surface of a pipeline and heat transfer medium with further heat treating until the bonding agent is cured, further removal of inner tubular film and providing a lining;

EX1007 at p. 5, 1:3-16, emphasis added.

200. While Khramenkov does not explicitly state that its three-layer inner tubular film is impermeable to liquids, a POSITA would have understood that in order to inflate the “inner tubular film by introducing pressurized air or water,” the inner tubular film of Khramenkov would have to be liquid impermeable. Further, Khramenkov discusses the liquid impermeability of the outer tubular film and the importance of the reactive resin not coming into contact with water:

Outer tubular film in contact with a defective pipeline prevents external intrusion of groundwater into uncured tubular lining and, thereby, protects it from washing out the uncured bonding agent; absorption of water prevents bonding agent from curing (water is an inhibitor of the curing process). The resulting thermoplastic coating in contact with the transported liquid increases impermeability of a pipeline, improves its throughput, and prevents abrasive wear.

EX1007 at p. 6, 1:32-41.

201. Therefore, a POSITA contemplating Khramenkov would understand that the inner tubular film of Khramenkov must be impermeable to liquids to allow for curing via inflation with water. For at least these reasons, Khramenkov teaches “[a]n optionally nonconditioned multilayer film that is impermeable to liquids...”.

202. The curing method taught by Khramenkov is a heat-based curing mechanism. EX1007 at p. 5, 1:3-16. Therefore, Khramenkov does not explicitly discuss if the inner tubular film “is at least to some extent permeable to UV radiation.” The multilayer inner tubular film of Khramenkov comprises the following composition and layer structure:

Here, inner three-layer tubular film 4 has interconnected first outer layer 6 of polyamide 6 as a thermoplastic polymer material adjacent to the inner surface of reinforcing tubular lining 2 and capable of being split off from this tubular lining, second intermediate layer 7 in contact with outer layer 6 and comprising polyamide 12 or polyamide-based polymer adhesive as a thermoplastic material, and third inner layer 8 in contact with intermediate layer 7 and comprising a mixture of polyethylene with polypropylene as a thermoplastic polymer material, where one, polyethylene, may be molten when heated, and the other, polypropylene, is not molten and does not deteriorate, which contributes to the formation of a molten phase of a fusible polymer – polyethylene which is distributed among the defects of intermediate layer 7.

EX1007 at p. 6, 2:8-25, emphasis added.

203. The layer structure of the inner tubular film of Khramenkov is further demonstrated in Figure 9 below:

4 - Inner tubular film (6 + 7 + 8)

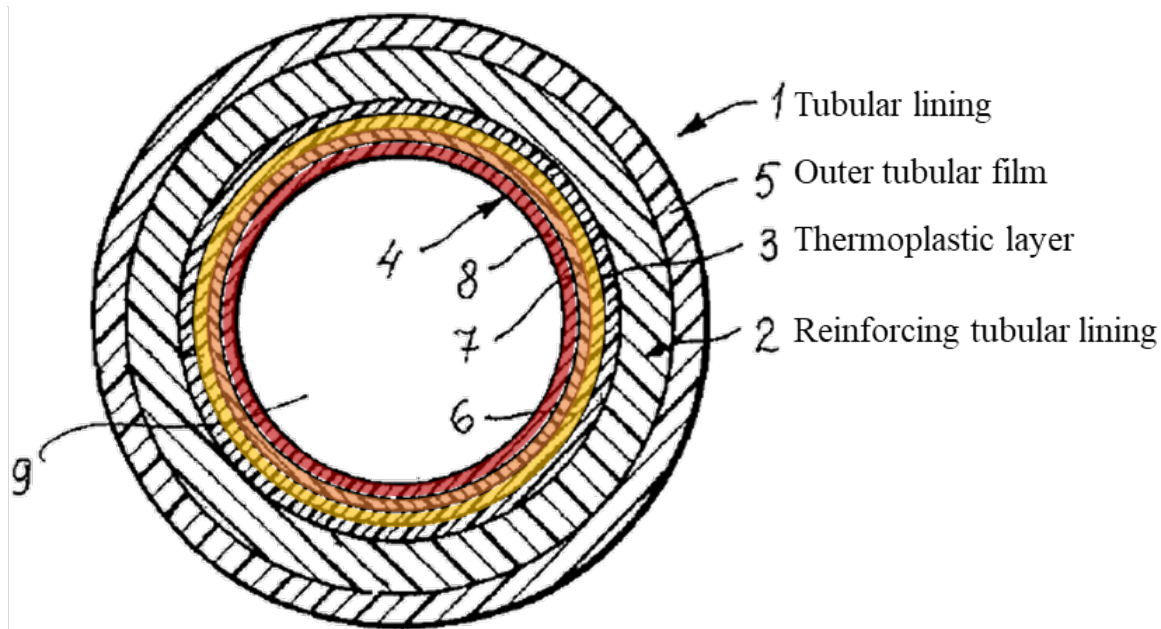


Fig. 1 6 - First outer layer of inner tubular film
 7 - Second intermediate layer of inner tubular film
 8 - Third inner layer of inner tubular film

Figure 9. Figure 1 of Khramenkov showing the layer structure of the inner tubular film 4 including thermoplastic layers 6, 7, and 8. EX1007 at p. 2, Fig. 1, annotations added.

204. A POSITA contemplating Khramenkov would have known that a three-layer film comprising a first external layer of polyamide 6, an internal layer of polyamide 12 or other polyamide, and a second external layer of a mixture of polyethylene with polypropylene could be “at least to some extent permeable to UV radiation.” Therefore, Khramenkov teaches “[a]n optionally nonconditioned multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation, comprising a layer sequence made of.”

205. To the extent it is argued that Khramenkov does not teach “[a]n optionally nonconditioned multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation, comprising a layer sequence made of,” Khramenkov in view of Jones meets this limitation.

206. Similar to Khramenkov, Jones is directed towards the use of multilayer polymeric films in reconditioning sewer pipes:

It has been proposed to recondition pipes, for example sewer pipes, using an impermeable polymeric film securely attached to a fibrous mat, the mat being impregnated with a synthetic resin composition. The synthetic resin composition is cured in situ in the pipe while pressure is applied to the film to cause it to conform to the interior surface of the pipe.

207. EX1009 at p. 2, lns. 2-3.

208. The multilayer polymeric film of Jones has the following composition and layer sequence:

According to the present invention there is provided a multilayer polymeric film comprising a layer of a nylon polymer having a Vicat A (DIN 53460) softening point of not more than 170 °C and being substantially impermeable to styrene, and a layer of a weldable synthetic plastics composition bonded to the layer of the nylon polymer.

EX1009 at p. 2, lns. 14-17.

209. Jones further teaches that its multilayer film is impermeable to liquids due to the “good barrier properties” of the nylon layer:

Preferred nylon polymers for use in the present invention by virtue of their particularly good barrier properties to synthetic resin compositions conventionally used, and the good adhesion which they

exhibit to the weldable synthetic plastics composition, are those containing units from at least two and more preferably at least three nylon monomers.

EX1009 at p. 2, lns. 28-31.

210. Jones also teaches that the reactive resin impregnated into the fibrous mat can be cured through heat or ultra-violet light. EX1009 at p. 2, lns. 7-9, *see also*, EX1009 at p. 3, lns. 26-28. In order for the light-activatable catalyst in the reactive resin to cure while the multilayer film applies pressure to the fibrous mat causing it to conform to the interior surface of the pipe, a POSITA would have understood that the multilayer film would need to be at least to some extent permeable to UV radiation.

211. Therefore, for at least these reasons, Jones teaches “an optionally nonconditioned multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation, comprising a layer sequence made of.”

212. A POSITA would have been motivated to modify the inner tubular film of Khramenkov to be at least to some extent permeable to UV radiation in view of the multilayer film used in Jones. It would have been obvious to a POSITA contemplating Khramenkov to consider Jones as both Khramenkov and Jones teach the use of insertion tubes for pipe renovation. EX1007 at p. 4, 1:1-8, EX1009 at p. 2, lns. 2-3. The teaching of a UV permeable inner tubular film of Jones would have led a POSITA to modify the inner tubular film of Khramenkov to be “at least

to some extent permeable to UV radiation.” As discussed in Section VI.A, UV curing was developed for use in CIPP liners in the early 2000s. A POSITA would have been aware of this curing method, and would be motivated to make the inner tubular film of Khramenkov at least to some extent permeable to UV radiation to increase the number of catalysts and reactive resins that would be compatible with the CIPP liner of Khramenkov.

213. As discussed above in Section VI.A, there are three curing mechanisms used in CIPP liners: heat, UV light, and ambient curing mechanisms. Therefore, modifying the multilayer film of Khramenkov to be at least to some extent permeable to UV radiation to allow for the use of UV curable reactive resin would have been obvious for a POSITA to try with a reasonable expectation of success as UV curing is one of a finite number of curing methods for CIPP liners.

214. Therefore, Khramenkov in view of Jones teaches “[a]n optionally nonconditioned multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation, comprising a layer sequence...” and meets this limitation.

c) Claim Element 1A-1

a layer (a) comprised of at least one thermoplastic olefin homo- or copolymer, as one of the external layers,

215. The multilayer inner tubular film of Khramenkov comprises the following composition and layer structure:

Here, inner three-layer tubular film 4 has interconnected first outer layer 6 of polyamide 6 as a thermoplastic polymer material adjacent to the inner surface of reinforcing tubular lining 2 and capable of being split off from this tubular lining, second intermediate layer 7 in contact with outer layer 6 and comprising polyamide 12 or polyamide-based polymer adhesive as a thermoplastic material, and third inner layer 8 in contact with intermediate layer 7 and comprising a mixture of polyethylene with polypropylene as a thermoplastic polymer material, where one, polyethylene, may be molten when heated, and the other, polypropylene, is not molten and does not deteriorate, which contributes to the formation of a molten phase of a fusible polymer – polyethylene which is distributed among the defects of intermediate layer 7.

EX1007 at p. 6, 2:8-25, emphasis added.

216. As shown above, inner layer 8 of Khramenkov comprises “a mixture of polyethylene with polypropylene as a thermoplastic polymer material.” As discussed above in Section VI.B, polyethylene and polypropylene are thermoplastic polyolefins. This layer 8 is an exterior layer of the inner tubular film 4 as shown in Figure 10 below:

4 - Inner tubular film (6 + 7 + 8)

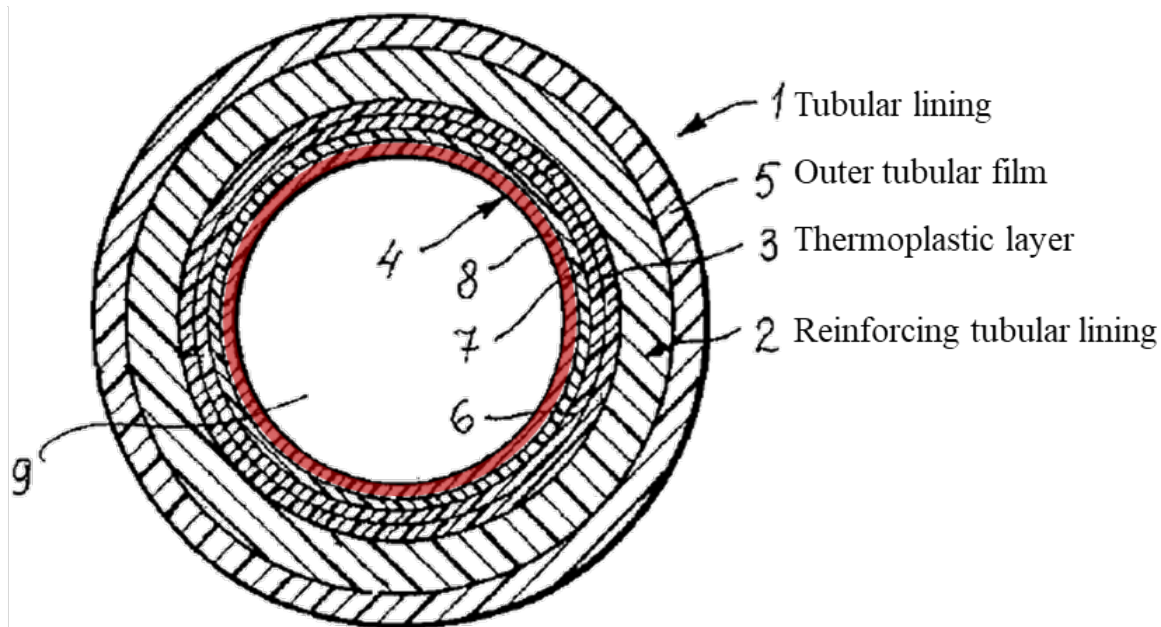


Fig. 1 6 - First outer layer of inner tubular film
 7 - Second intermediate layer of inner tubular film
 8 - Third inner layer of inner tubular film

Figure 10. Figure 1 of Khramenkov showing the layer structure of the inner tubular film 4 including the inner layer of the inner tubular film, layer 8. EX1007 at p. 2, Fig. 1, annotations added.

217. Therefore, Khramenkov teaches “a layer (a) comprised of at least one thermoplastic olefin homo- or copolymer, as one of the external layers” and meets this limitation.

d) Claim Element 1A-2

an adhesive-promoter layer (b),

218. Khramenkov teaches that the three layers of its multilayer film are connected by melting. EX1007 at p. 7, 1:39-41.

219. Jones teaches the use of bonding layers between the layers of its multilayer film:

In a preferred embodiment of the invention, a bonding layer can be provided between the nylon polymer layer and the weldable synthetic plastics composition. The bonding layer can be a coextruded tie layer or a laminating adhesive, depending on the method used to manufacture films of the present invention. Suitable polymeric materials for use as the bonding layer include modified polyolefins, e.g. modified polyethylene or modified polypropylene, polyurethane, polymers containing units derived from ethylene and at least one of vinyl acetate, acrylic acid and lower C₁₋₄ alkyl acrylates, e.g. ethyl acrylate, and modified equivalents of such polymers, the modification in each case preferably being by the inclusion of units derived from maleic anhydride.

EX1009 at p. 2, lns. 42-49.

220. It would have been obvious to a POSITA contemplating Khramenkov to consider Jones as both Khramenkov and Jones teach the use of insertion tubes for pipe renovation. EX1007 at p. 4, 1:1-8, EX1009 at p. 2, lns. 2-3. A POSITA would have been motivated to utilize the bonding layers of Jones between the three layers of the multilayer film of Khramenkov. Utilizing bonding layers (*i.e.*, adhesive-promoter layers) in the multilayer film of Khramenkov would allow the film to be manufactured in one step through co-extrusion of the adhesive-promoter layers, as taught by Jones, between the three disclosed layers of the multilayer film of Khramenkov. A POSITA would have been motivated to remove the secondary step of melting the layers together to reduce manufacturing time and cost of

Khramenkov's multilayer film, while still maintaining a strong bond between the layers.

221. Accordingly, the multilayer sequence taught by Khramenkov modified by a POSITA to include the bonding layer taught by Jones comprises:

External layer (a): mixture of polyethylene with polypropylene (Khramenkov layer 8)

Internal layer (b): bonding layer, as taught by Jones

Internal layer (c): polyamide 12 or polyamide-based polymer adhesive (Khramenkov layer 7)

Internal layer (d): bonding layer, as taught by Jones

External layer (e): polyamide 6 (Khramenkov layer 6).

222. Therefore, Khramenkov in view of Jones teaches "an adhesive-promoter layer (b)" and meets this limitation.

e) Claim Element 1A-3

an internally situated layer (c) comprised of at least one homo- and/or copolyamide,

223. The multilayer inner tubular film of Khramenkov comprises the following composition and layer structure:

Here, inner three-layer tubular film 4 has interconnected first outer layer 6 of polyamide 6 as a thermoplastic polymer material adjacent to the inner surface of reinforcing tubular lining 2 and capable of being split off from this tubular lining, second intermediate layer 7 in contact with outer layer 6 and comprising polyamide 12 or polyamide-based polymer adhesive as a thermoplastic material, and third inner layer 8 in contact with intermediate layer 7 and comprising a mixture of polyethylene with polypropylene as a thermoplastic polymer material, where one, polyethylene, may be molten when heated, and

the other, polypropylene, is not molten and does not deteriorate, which contributes to the formation of a molten phase of a fusible polymer – polyethylene which is distributed among the defects of intermediate layer 7.

EX1007 at p. 6, 2:8-25, emphasis added.

224. As shown above, inner layer 7 of Khramenkov comprises “polyamide 12.” This layer 7 of the inner tubular film 4 of Khramenkov is shown in Figure 11 below:

4 - Inner tubular film (6 + 7 + 8)

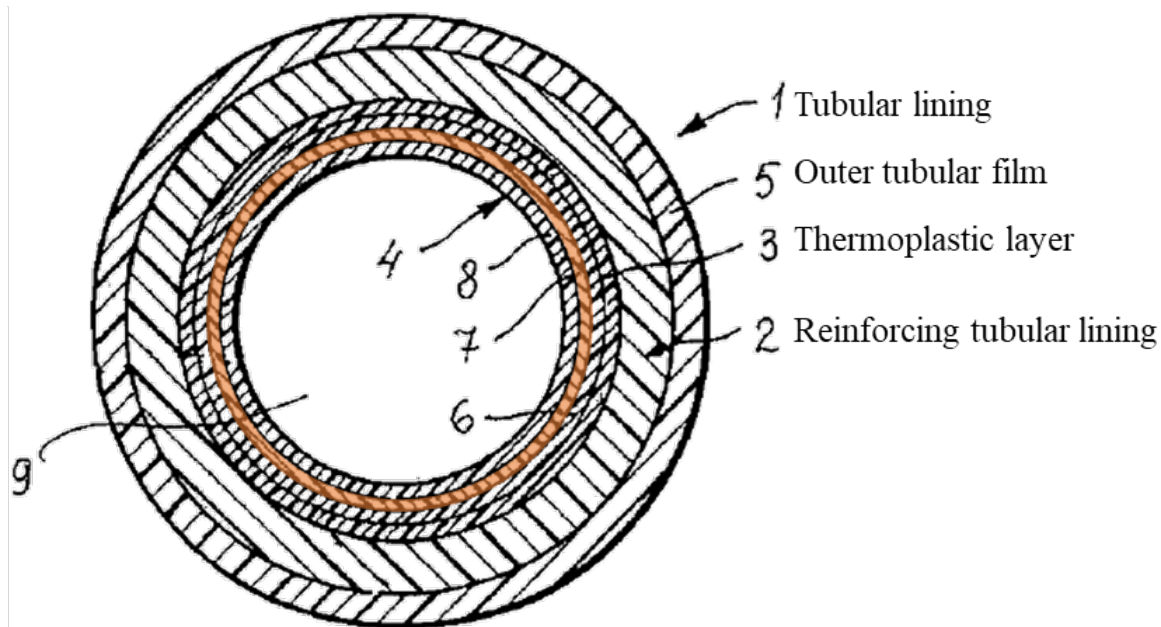


Fig. 1 6 - First outer layer of inner tubular film
7 - Second intermediate layer of inner tubular film
8 - Third inner layer of inner tubular film

Figure 11. Figure 1 of Khramenkov showing the layer structure of the inner tubular film 4 including the internal layer of the inner tubular film, layer 7.
EX1007 at p. 2, Fig. 1, annotations added.

225. As described above in Section IX.B.1.d), a POSITA would have been motivated to utilize the bonding layers of Jones between the three layers of the multilayer film of Khramenkov and the resulting multilayer film composition and layer sequence would comprise:

External layer (a): mixture of polyethylene with polypropylene (Khramenkov layer 8)

Internal layer (b): bonding layer, as taught by Jones

Internal layer (c): polyamide 12 or polyamide-based polymer adhesive (Khramenkov layer 7)

Internal layer (d): bonding layer, as taught by Jones

External layer (e): polyamide 6 (Khramenkov layer 6).

226. As shown above, layer (c) is an internally situated layer. Therefore, Khramenkov teaches “an internally situated layer (c) comprised of at least one homo- and/or copolyamide” and meets this limitation.

f) Claim Element 1A-4

an adhesive-promoter layer (d), and

227. Khramenkov teaches that the three layers of its multilayer film are connected by melting. EX1007 at p. 7, 1:39-41.

228. Jones teaches the use of bonding layers between the layers of its multilayer film:

In a preferred embodiment of the invention, a bonding layer can be provided between the nylon polymer layer and the weldable synthetic plastics composition. The bonding layer can be a coextruded tie layer or a laminating adhesive, depending on the method used to

manufacture films of the present invention. Suitable polymeric materials for use as the bonding layer include modified polyolefins, e.g. modified polyethylene or modified polypropylene, polyurethane, polymers containing units derived from ethylene and at least one of vinyl acetate, acrylic acid and lower C₁₋₄ alkyl acrylates, e.g. ethyl acrylate, and modified equivalents of such polymers, the modification in each case preferably being by the inclusion of units derived from maleic anhydride.

EX1009 at p. 2, lns. 42-49.

229. It would have been obvious to a POSITA contemplating Khramenkov to consider Jones as both Khramenkov and Jones teach the use of insertion tubes for pipe renovation. EX1007 at p. 4, 1:1-8, EX1009 at p. 2, lns. 2-3. A POSITA would have been motivated to utilize the bonding layers of Jones between the three layers of the multilayer film of Khramenkov. Utilizing bonding layers (*i.e.*, adhesive-promoter layers) in the multilayer film of Khramenkov would allow the film to be manufactured in one step through co-extrusion of the adhesive-promoter layers, as taught by Jones, between the three disclosed layers of the multilayer film of Khramenkov. A POSITA would have been motivated to remove the secondary step of melting the layers together to reduce manufacturing time and cost of Khramenkov's multilayer film, while still maintaining a strong bond between the layers.

230. Accordingly, the multilayer sequence taught by Khramenkov modified by a POSITA to include the bonding layer taught by Jones comprises:

External layer (a): mixture of polyethylene with polypropylene (Khramenkov layer 8)

Internal layer (b): bonding layer, as taught by Jones

Internal layer (c): polyamide 12 or polyamide-based polymer adhesive (Khramenkov layer 7)

Internal layer (d): bonding layer, as taught by Jones

External layer (e): polyamide 6 (Khramenkov layer 6).

231. Therefore, Khramenkov in view of Jones teaches “an adhesive-promoter layer (d)” and meets this limitation.

g) Claim Element 1A-5

a layer (e) comprised of at least one homo- and/or copolyamide, as one of the external layers,

232. The multilayer inner tubular film of Khramenkov comprises the following composition and layer structure:

Here, inner three-layer tubular film 4 has interconnected first outer layer 6 of polyamide 6 as a thermoplastic polymer material adjacent to the inner surface of reinforcing tubular lining 2 and capable of being split off from this tubular lining, second intermediate layer 7 in contact with outer layer 6 and comprising polyamide 12 or polyamide-based polymer adhesive as a thermoplastic material, and third inner layer 8 in contact with intermediate layer 7 and comprising a mixture of polyethylene with polypropylene as a thermoplastic polymer material, where one, polyethylene, may be molten when heated, and the other, polypropylene, is not molten and does not deteriorate, which contributes to the formation of a molten phase of a fusible polymer – polyethylene which is distributed among the defects of intermediate layer 7.

EX1007 at p. 6, 2:8-25, emphasis added.

233. As shown above, first outer layer 6 of Khramenkov comprises polyamide 6. This layer 6 is an exterior layer of the inner tubular film 4 as shown in Figure 12 below:

4 - Inner tubular film (6 + 7 + 8)

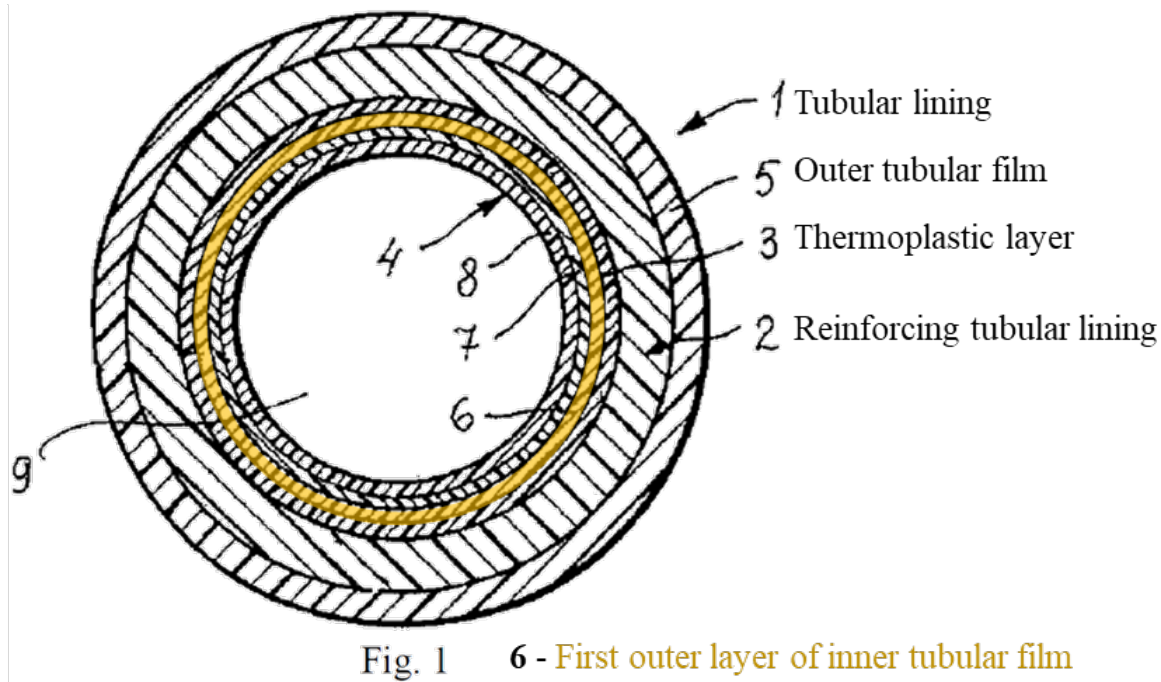


Fig. 1 6 - First outer layer of inner tubular film

7 - Second intermediate layer of inner tubular film

8 - Third inner layer of inner tubular film

Figure 12. Figure 1 of Khramenkov showing the layer structure of the inner tubular film 4 including the outer layer of the inner tubular film, layer 6. EX1007 at p. 2, Fig. 1, annotations added.

234. Therefore, Khramenkov teaches “a layer (e) comprised of at least one homo- and/or copolyamide, as one of the external layers” and meets this limitation.

h) Claim Element 1A-6

in the form of a tubular film,

235. Khramenkov describes its multilayer film (*i.e.*, item 4 shown in Figure 13 below) as an “inner tubular film.” EX1007 at p. 6, 1:60.

4 - Inner tubular film (6 + 7 + 8)

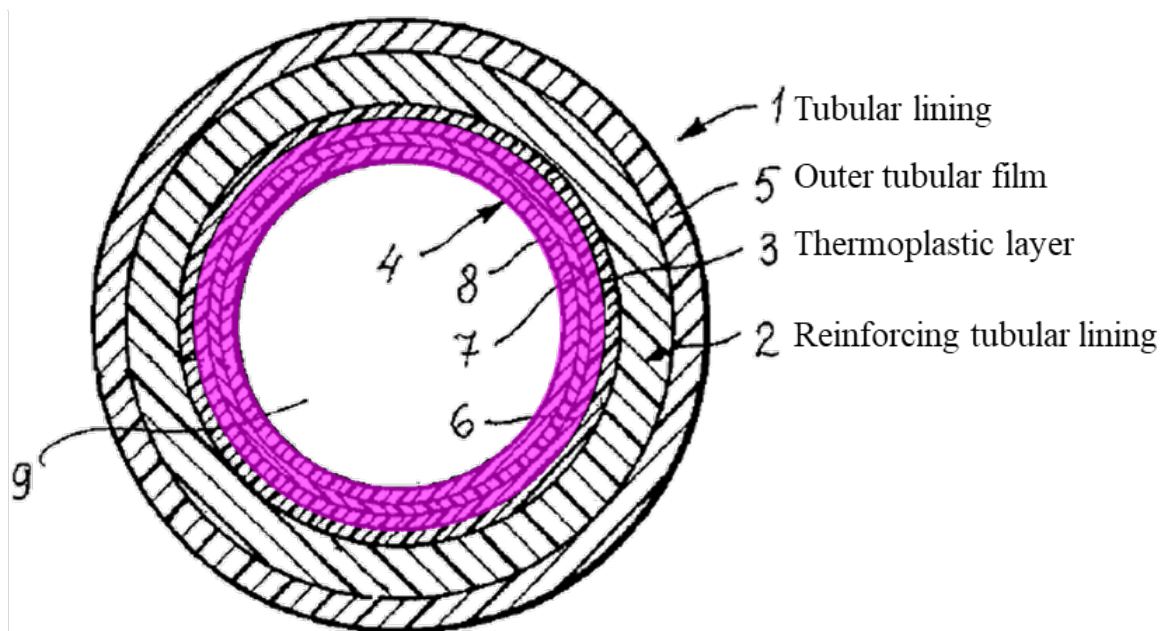


Fig. 1 6 - First outer layer of inner tubular film
 7 - Second intermediate layer of inner tubular film
 8 - Third inner layer of inner tubular film

Figure 13. Figure 1 of Khramenkov showing inner tubular film 4 including thermoplastic layers 6, 7, and 8. EX1007 at p. 2, Fig. 1, annotations added.

236. Therefore, Khramenkov teaches a multilayer film “in the form of a tubular film” and therefore meets this limitation.

i) Claim Element 1A-7

wherein the VICAT softening point of the thermoplastic olefin homo- or copolymer of the layer (a) is at least 100°C.;

237. While Jones discloses the softening temperature of the external nylon layer to be below 170 °C, neither Khramenkov nor Jones explicitly disclose the softening point of their olefin-based layers. EX1009 at p. 2, 2:14-17. As discussed above in Section IX.B.1.c), layer 8 (*i.e.*, layer (a)) disclosed by Khramenkov comprises a mixture of polyolefins, specifically polyethylene with polypropylene. Khramenkov further specifies the composition of this olefin layer:

Inner layer 8 of inner tubular film 4 comprises a mixture of polyethylene in the amount of 20-40 wt.% with polypropylene in the amount of 80-60 wt.%.

EX1007 at p. 7, 1:20-23.

238. Further, the curing method taught by Khramenkov is a heat-based curing mechanism that utilizes temperatures of 80 to 100 °C. EX1007 at p. 5, 1:3-16, 1:50-58. While Khramenkov does not explicitly disclose the VICAT softening temperature of its olefin mixture layer, inner layer 8, a POSITA would have been motivated to utilize a mixture of polyethylene and polypropylene for inner layer 8 with a VICAT of at least 100 °C to ensure the inner tubular film would be able to retain its necessary mechanical properties during a heat-based curing process.

239. As discussed above in Section VI.B, polyolefins, such as polyethylene and polypropylene have a range of VICAT softening temperatures. Specifically, homopolymer polypropylene has a VICAT softening point in the range of 145-150 °C, while the VICAT softening point for homopolymer polyethylene has a

softening point in the range of 85 to 130 °C, depending on the density. Low density polyethylene grades have a softening point in the range of 85-102 °C, while high density polyethylene grades have a softening point in the range of 120-130 °C.

240. A layer with a higher content of polyethylene would result in a lower VICAT softening point since the VICAT softening point for polyethylene is less than that of polypropylene. Assuming a layer composition of 40% polyethylene with a VICAT softening point of 85 °C and 60% polypropylene with a VICAT softening point of 145 °C (this composition would result in the layer with the lowest VICAT softening point), the estimated VICAT softening point for the layer would be approximately 120 °C. This VICAT softening point exceeds 100 °C.

241. As discussed above, a POSITA would have been motivated to ensure the inner tubular film could retain its necessary mechanical properties during a heat-based curing process that could reach up to 100 °C, and would therefore have been motivated to ensure the inner layer 8 would have had a VICAT softening point above 100 °C. The mixture of polyolefins disclosed by Khramenkov, even using the highest disclosed percentage of polyethylene with a relatively low VICAT softening point, still results in an inner layer 8 with a VICAT softening point that exceeds 100 °C.

242. Therefore, Khramenkov in view of Jones teaches a multilayer film
“wherein the VICAT softening point of the thermoplastic olefin homo- or
copolymer of the layer (a) is at least 100°C” and meets this limitation.

j) Claim Element 1A-8

as internally situated tube, and

243. The multilayer inner tubular film of Khramenkov is situated on the
interior surface of the CIPP liner taught by Khramenkov, as shown in Figure 14
below:

4 - Inner tubular film (6 + 7 + 8)

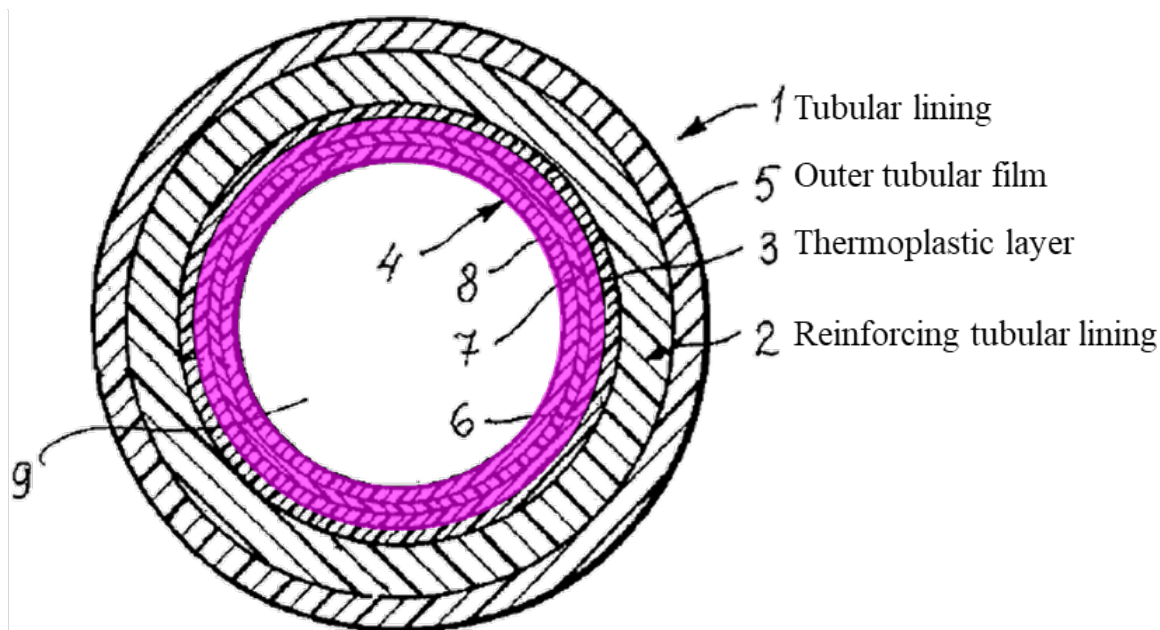


Fig. 1 6 - First outer layer of inner tubular film
 7 - Second intermediate layer of inner tubular film
 8 - Third inner layer of inner tubular film

Figure 14. Figure 1 of Khramenkov showing inner tubular film 4, comprising
thermoplastic layers 6, 7, and 8, situated on the interior surface of
Tubular lining 1. EX1007 at p. 2, Fig. 1, annotations added.

244. Therefore, Khramenkov teaches a multilayer film “as internally situated tube” and meets this limitation.

k) Claim Elements 1B

an externally situated single- or multilayer tubular film which is impermeable to liquids, and which reflects and/or absorbs UV radiation and/or short-wave, visible light, as externally situated tube, and

245. Khramenkov teaches:

To achieve this object, in the method for applying tubular lining onto the inner surface of a pipeline, comprising: placing reinforcing tubular lining impregnated with a curing bonding agent between inner and outer three-layer tubular films made of thermoplastic polymeric materials, outside a pipeline; inserting inner tubular film with reinforcing tubular lining in a pipeline and inflating inner tubular film by introducing pressurized air or water so that tubular lining contacts evenly with the inner surface of a pipeline and heat transfer medium with further heat treating until the bonding agent is cured, further removal of inner tubular film and providing a lining;

EX1007 at p. 5, 1:3-16, emphasis added.

246. The outer tubular film, item 5, is shown in Figure **15** below situated on the exterior of the CIPP liner:

4 - Inner tubular film (6 + 7 + 8)

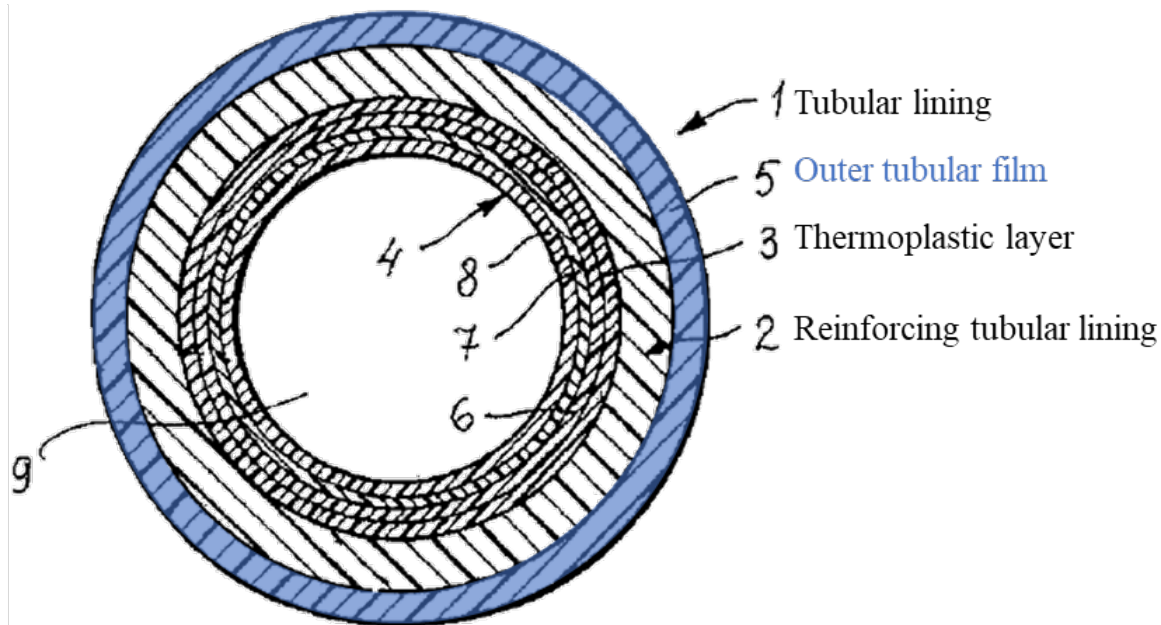


Fig. 1 6 - First outer layer of inner tubular film
7 - Second intermediate layer of inner tubular film
8 - Third inner layer of inner tubular film

Figure 15. Figure 1 of Khramenkov showing outer tubular film 5 situated on the exterior surface of Tubular lining 1. EX1007 at p. 2, Fig. 1, annotations added.

247. Therefore, Khramenkov teaches “an externally situated single- or multilayer tubular film...”

248. Khramenkov further describes the outer tubular film:

Outer tubular film in contact with a defective pipeline prevents external intrusion of groundwater into uncured tubular lining and, thereby, protects it from washing out the uncured bonding agent; absorption of water prevents bonding agent from curing (water is an inhibitor of the curing process). The resulting thermoplastic coating in contact with the transported liquid increases impermeability of a pipeline, improves its throughput, and prevents abrasive wear.

EX1007 at p. 6, 1:32-42.

249. Therefore, Khramenkov teaches “an externally situated single- or multilayer tubular film which is impermeable to liquids...”

250. The curing method taught by Khramenkov is a heat-based curing mechanism. EX1007 at p. 5, 1:3-16. Therefore, Khramenkov does not explicitly discuss if the outer tubular film “reflects and/or absorbs UV radiation and/or short-wave, visible light.” However, a POSITA would have known that all polymer films reflect and/or absorb at least some UV radiation and/or short-wave, visible light and do not achieve 100% transmission. Further, Jones teaches that the reactive resin impregnated into the fibrous mat can be cured through heat or ultra-violet light. EX1009 at p. 2, lns. 7-9, *see also*, EX1009 at p. 3, lns. 26-28. In order for the light-activatable catalyst in the reactive resin to not cure prematurely before installation, the reactive resin cannot be exposed to any UV light sources. This could be achieved either through storage in dark conditions, or through the use of an outer tubular film which is not permeable to UV light.

251. A POSITA contemplating Khramenkov in view of Jones would be motivated to modify the outer tubular film of Khramenkov to reflect and/or absorb UV radiation and/or short-wave, visible light. It would have been obvious to a POSITA contemplating Khramenkov to consider Jones as both Khramenkov and Jones teach the use of insertion tubes for pipe renovation. EX1007 at p. 4, 1:1-8,

EX1009 at p. 2, lns. 2-3. As discussed in Section VI.A, UV curing was developed for use in CIPP liners in the early 2000s. A POSITA would have been aware of this curing method, and would be motivated to make the outer tubular film of Khramenkov reflect and/or absorb UV radiation and/or short-wave, visible light to increase the number of catalysts and reactive resins that would be compatible with the CIPP liner of Khramenkov. The use of an outer tubular film that reflects and/or absorbs UV radiation and/or short-wave, visible light also would simplify the storage of the resin impregnated CIPP liner before installation, as it would not be necessary to store the liner in dark conditions.

252. As discussed above in Section VI.A, there are three curing mechanisms used in CIPP liners: heat, UV light, and ambient curing mechanisms. Therefore, modifying the outer tubular film of Khramenkov to reflect and/or absorb UV radiation and/or short-wave, visible light to allow for the use of UV curable reactive resin would have been obvious for a POSITA to try with a reasonable expectation of success as UV curing is one of a finite number of curing methods for CIPP liners.

253. Therefore, Khramenkov in view of Jones teaches “an externally situated single- or multilayer tubular film which is impermeable to liquids, and which reflects and/or absorbs UV radiation and/or short-wave, visible light, as externally situated tube” and meets this limitation

I) Claim Element 1C

a support material situated therebetween and saturated with a reactive synthetic resin.

254. Khramenkov teaches:

To achieve this object, in the method for applying tubular lining onto the inner surface of a pipeline, comprising: placing reinforcing tubular lining impregnated with a curing bonding agent between inner and outer three-layer tubular films made of thermoplastic polymeric materials, outside a pipeline; inserting inner tubular film with reinforcing tubular lining in a pipeline and inflating inner tubular film by introducing pressurized air or water so that tubular lining contacts evenly with the inner surface of a pipeline and heat transfer medium with further heat treating until the bonding agent is cured, further removal of inner tubular film and providing a lining;

EX1007 at p. 5, 1:3-16, emphasis added.

255. Khramenkov further describes that the inner surface of the reinforcing tubular lining is formed from a thermoplastic layer:

according to the invention, before tubular films are placed outside a pipeline, a thermoplastic layer is placed on the surface of reinforcing tubular lining strongly bonded to the reinforcing tubular lining, which forms the inner surface of this lining and is in contact with inner tubular film,

EX1007 at p. 5, 1:16-22, emphasis added.

256. Therefore, a POSITA contemplating Khramenkov would have understood thermoplastic layer and the reinforcing tubular lining to constitute the support material. The support material comprising the reinforcing tubular lining with an inner surface formed from the thermoplastic layer, is discussed by Khramenkov with respect to Figure 1.

The proposed method for applying tubular lining 1 (Fig. 1) onto the inner surface of a pipeline comprises the following: first, thermoplastic layer 3 strongly bonded to reinforcing tubular lining 2 being an internal surface of this tubular lining 2 made of synthetic polyester fiber felt and in contact with inner tubular film 4, is applied onto the surface of reinforcing tubular lining 2, and lateral end portions of reinforcing tubular lining 2 with lateral end portions of thermoplastic layer 3 are interconnected, outside the pipeline.

EX1007 at p. 6, 1:52-63, emphasis added.

257. The support material impregnated with reactive resin is shown below in Figure 16:

4 - Inner tubular film (6 + 7 + 8)

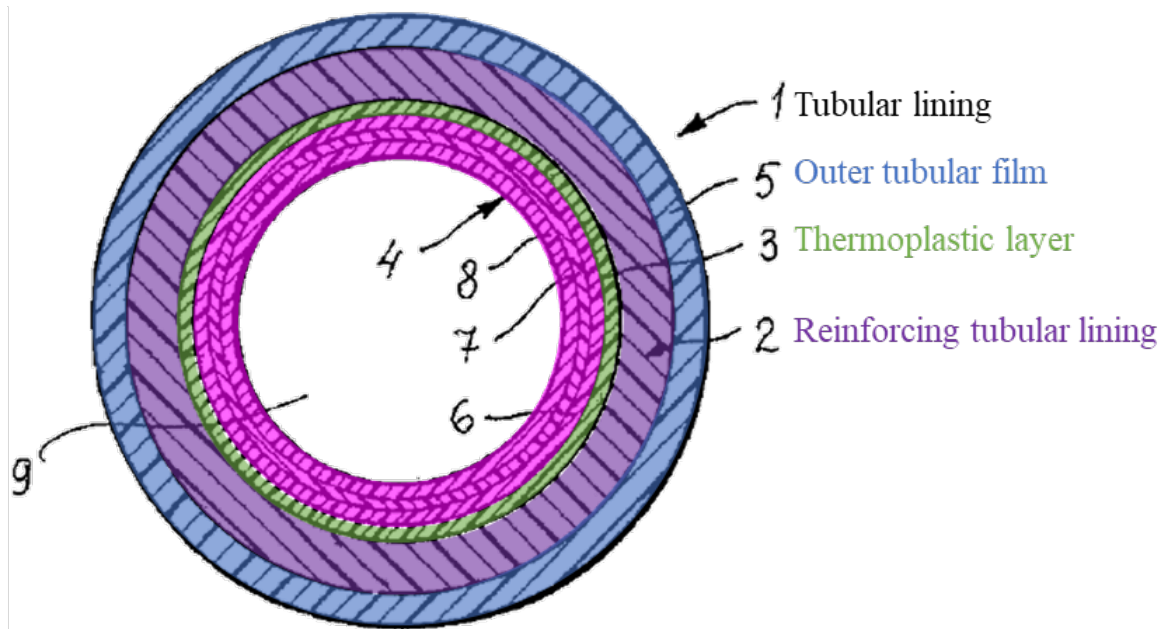


Fig. 1 6 - First outer layer of inner tubular film
7 - Second intermediate layer of inner tubular film
8 - Third inner layer of inner tubular film

Figure 16. Figure 1 of Khramenkov showing the reinforcing tubular lining 2 with internal surface formed by thermoplastic layer 3 (*i.e.*, together forming the support material impregnated with reactive resin) situated between outer tubular film 5 and inner tubular film 4. EX1007 at p. 2, Fig. 1, annotations added.

258. Therefore, Khramenkov teaches “a support material situated therebetween and saturated with a reactive synthetic resin” and meets this limitation.

259. For at least the reasons described above, Khramenkov in view of Jones renders obvious Claim 1.

2. Claim 2

The insertion tube as claimed in claim 1, wherein the thickness of the layer (a) is at least 40% of the total thickness of the multilayer film that is impermeable to liquids and at least to some extent permeable to UV radiation.

260. As discussed above, Khramenkov in view of Jones renders obvious Claim 1, from which Claim 2 depends. As described above in Section IX.B.1.d), the multilayer film taught by Khramenkov modified by a POSITA in view of Jones comprises:

External layer (a): mixture of polyethylene with polypropylene (Khramenkov layer 8)

Internal layer (b): bonding layer, as taught by Jones

Internal layer (c): polyamide 12 or polyamide-based polymer adhesive (Khramenkov layer 7)

Internal layer (d): bonding layer, as taught by Jones

External layer (e): polyamide 6 (Khramenkov layer 6).

261. While Khramenkov does not disclose the individual thicknesses of each of the layers, it would have been obvious for a POSITA to utilize a layer configuration for the multilayer film wherein the thickness of the layer (a) is at least 40% of the total thickness. A POSITA would have been motivated by the reduced cost of polyolefins compared to polyamides – having a multilayer film comprising *at least* 40% polyolefin would cost less than a multilayer film with higher amounts of polyamide. Further, a POSITA would have known that polyolefins are known for their flexibility and elasticity and are generally less stiff

than polyamides. *See* Section VI.B. Therefore, a POSITA would have been motivated to construct the inner tubular film of Khramenkov in view of Jones in a cost-effective manner using a polyolefin layer (a) thickness of greater than 40% of the total film thickness to allow the film to be sufficiently elastic to withstand the inflation pressures used during installation as disclosed by Khramenkov. EX1007 at p. 5, 1:49-58.

262. Therefore, Khramenkov in view of Jones teaches a multilayer film “wherein the thickness of the layer (a) is at least 40% of the total thickness of the multilayer film that is impermeable to liquids and at least to some extent permeable to UV radiation” and therefore renders obvious Claim 2.

3. Claim 3

[3a] The insertion tube as claimed in claim 1, wherein the layer (a) of the multilayer film that is impermeable to liquids and at least to some extent permeable to UV radiation is comprised of

[3b] at least one ethylene homo- or copolymer and/or

[3c] at least one propylene homo- or copolymer.

263. Claim elements [3b] and [3c] are stated in the disjunctive “or” meaning either [3b] or [3c] can be true or both; *i.e.*, if [3a] and either [3b] or [3c] are found in Khramenkov in view of Jones, then the limitations of this claim are met.

264. As discussed above, Khramenkov in view of Jones renders obvious Claim 1, from which Claim 3 depends. As discussed above in Section IX.B.1.c)

and IX.B.1.d), layer 8 of Khramenkov comprises “a mixture of polyethylene with polypropylene” and is layer (a) of the multilayer inner tubular film of Khramenkov modified by a POSITA in view of Jones. Polyethylene is an ethylene homopolymer and polypropylene is a propylene homopolymer. Therefore, Khramenkov in view of Jones teaches all limitations of Claim 3, specifically:

[3a] The insertion tube as claimed in claim 1, wherein the layer (a) of the multilayer film that is impermeable to liquids and at least to some extent permeable to UV radiation is comprised of

[3b] at least one ethylene homo- or copolymer and/or

[3c] at least one propylene homo- or copolymer.

265. For at least these reasons, Khramenkov in view of Jones renders obvious Claim 3.

4. Claim 4

[4a] The insertion tube as claimed in claim 1, wherein the layers (c) and (e) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation have an identical layer structure, optionally

[4b] an identical layer thickness, and/or

[4c] identical polyamide components, and/or

[4d] an identical composition, optionally an identical polyamide component.

266. Claim elements [4b], [4c] and [4d] are stated in the disjunctive “or” meaning either [4b], [4c] or [4d] can be true or more than one can; *i.e.*, if either

[4b], [4c] or [4d] is found in Khramenkov in view of Jones, then the limitations of this claim are met.

267. As discussed above, Khramenkov in view of Jones renders obvious Claim 1, from which Claim 4 depends. As discussed above in Section IX.B.1 with respect to Claim 1, Khramenkov in view of Jones teaches a multilayer film the following layer sequence:

External layer (a): mixture of polyethylene with polypropylene (Khramenkov layer 8)

Internal layer (b): bonding layer, as taught by Jones

Internal layer (c): polyamide 12 or polyamide-based polymer adhesive (Khramenkov layer 7)

Internal layer (d): bonding layer, as taught by Jones

External layer (e): polyamide 6 (Khramenkov layer 6).

268. As shown above, the multilayer film taught by Khramenkov in view of Jones comprises an internal layer (c) comprising polyamide 12 (*i.e.*, layer 7 of Khramenkov) and an external layer (e) comprising polyamide 6 (*i.e.*, layer 6 of Khramenkov). EX1007 at p. 6, 2:8-25. Therefore, layer (c) and (e) do not have identical polyamide components or an identical composition.

269. However, Khramenkov does not explicitly discuss the thicknesses of the two polyamide layers. Further, Figure 1 of Khramenkov shows the individual layers as approximately the same thickness, as shown below in Figure 17.

4 - Inner tubular film (6 + 7 + 8)

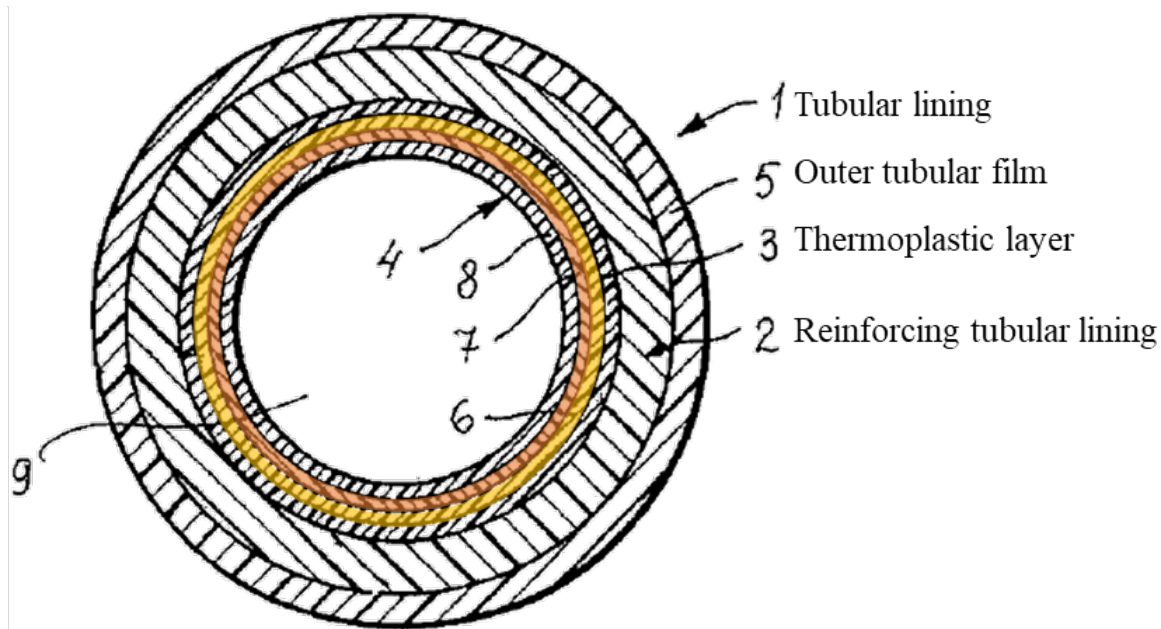


Fig. 1 6 - First outer layer of inner tubular film
 7 - Second intermediate layer of inner tubular film
 8 - Third inner layer of inner tubular film

Figure 17. Figure 1 of Khramenkov showing the layer structure of the inner tubular film 4 including thermoplastic layers 6, 7, and 8. Annotated layers 6 (comprising polyamide 6) and 7 (comprising polyamide 12) are shown to have identical layer thicknesses. EX1007 at p. 2, Fig. 1, annotations added.

270. It would therefore have been obvious for a POSITA to construct the inner tubular film of Khramenkov in view of Jones using identical layer thicknesses for layer (c) and layer (e), as shown in Figure 1 of Khramenkov. Identical layer thicknesses for layer (c) and layer (e) would have been obvious for a POSITA to try with a reasonable expectation of success.

271. Therefore, Khramenkov in view of Jones teaches the limitations of Claim 4, specifically:

[4a] The insertion tube as claimed in claim 1, wherein the layers (c) and (e) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation have an identical layer structure, optionally

[4b] an identical layer thickness, ...

272. For at least these reasons, Khramenkov in view of Jones renders obvious Claim 4.

5. Claim 5

[5a] The insertion tube as claimed in claim 1, wherein the layers (c) and (e) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation have a different layer structure, optionally

[5b] a different layer thickness, and/or

[5c] different polyamide components, and/or

[5d] a different composition.

273. Claim elements [5b], [5c] and [5d] are stated in the disjunctive “or” meaning either [5b], [5c] or [5d] can be true or more than one can; *i.e.*, if either [5b], [5c] or [5d] is found in Khramenkov in view of Jones, then the limitations of this claim are met.

274. As discussed above, Khramenkov in view of Jones renders obvious Claim 1, from which Claim 4 depends. As discussed above in Section IX.B.1 with

respect to Claim 1, Khramenkov in view of Jones teaches a multilayer film the following layer sequence:

External layer (a): mixture of polyethylene with polypropylene (Khramenkov layer 8)

Internal layer (b): bonding layer, as taught by Jones

Internal layer (c): polyamide 12 or polyamide-based polymer adhesive (Khramenkov layer 7)

Internal layer (d): bonding layer, as taught by Jones

External layer (e): polyamide 6 (Khramenkov layer 6).

275. As shown above, the multilayer film taught by Khramenkov in view of Jones comprises an internal layer (c) comprising polyamide 12 (*i.e.*, layer 7 of Khramenkov) and an external layer (e) comprising polyamide 6 (*i.e.*, layer 6 of Khramenkov). EX1007 at p. 6, 2:8-25. Therefore, Khramenkov teaches that layer (c) and layer (e) have different polyamide components. Therefore, Khramenkov in view of Jones teaches the limitations of Claim 4, specifically:

[5a] The insertion tube as claimed in claim 1, wherein the layers (c) and (e) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation have a different layer structure, optionally

[5c] different polyamide components, and/or

276. For at least these reasons, Khramenkov in view of Jones renders obvious Claim 5.

6. Claim 6

The insertion tube as claimed in claim 1, wherein the adhesive-promoter layers (b) and (d) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation comprise respectively mutually independently at least one modified thermoplastic olefin homo- or copolymer, optionally respectively mutually independently at least one modified thermoplastic ethylene homo- or copolymer and/or at least one modified propylene homo- or copolymer.

277. As discussed above, Khramenkov in view of Jones renders obvious Claim 1, from which Claim 6 depends. As described above in Section IX.B.1.d), the multilayer inner tubular film taught by Khramenkov modified by a POSITA in view of Jones comprises:

External layer (a): mixture of polyethylene with polypropylene (Khramenkov layer 8)

Internal layer (b): bonding layer, as taught by Jones

Internal layer (c): polyamide 12 or polyamide-based polymer adhesive (Khramenkov layer 7)

Internal layer (d): bonding layer, as taught by Jones

External layer (e): polyamide 6 (Khramenkov layer 6).

278. Further as discussed above in IX.B.1.d), Jones describes the composition of the bonding layers:

In a preferred embodiment of the invention, a bonding layer can be provided between the nylon polymer layer and the weldable synthetic plastics composition. The bonding layer can be a coextruded tie layer or a laminating adhesive, depending on the method used to manufacture films of the present invention. Suitable polymeric materials for use as the bonding layer include modified polyolefins, e.g. modified polyethylene or modified polypropylene, polyurethane,

polymers containing units derived from ethylene and at least one of vinyl acetate, acrylic acid and lower C₁₋₄ alkyl acrylates, e.g. ethyl acrylate, and modified equivalents of such polymers, the modification in each case preferably being by the inclusion of units derived from maleic anhydride.

EX1009 at p. 2, lns. 42-49, emphasis added.

279. Therefore, Khramenkov in view of Jones teaches a multilayer film “wherein the adhesive-promoter layers (b) and (d) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation comprise respectively mutually independently at least one modified thermoplastic olefin homo- or copolymer, optionally respectively mutually independently at least one modified thermoplastic ethylene homo- or copolymer and/or at least one modified propylene homo- or copolymer” and therefore renders obvious Claim 6.

7. Claim 7

The insertion tube as claimed in claim 1, wherein the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation consists of the layers (a)-(e).

280. As discussed above, Khramenkov in view of Jones renders obvious Claim 1, from which Claim 7 depends. As described above in Section IX.B.1.d), the multilayer inner tubular film taught by Khramenkov modified by a POSITA in view of Jones comprises:

External layer (a): mixture of polyethylene with polypropylene (Khramenkov layer 8)

Internal layer (b): bonding layer, as taught by Jones

Internal layer (c): polyamide 12 or polyamide-based polymer adhesive (Khramenkov layer 7)

Internal layer (d): bonding layer, as taught by Jones

External layer (e): polyamide 6 (Khramenkov layer 6).

281. Therefore, Khramenkov in view of Jones teaches “wherein the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation consists of the layers (a)-(e)” and therefore renders obvious Claim 7.

8. Claim 8

The insertion tube as claimed in claim 1, wherein the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation is permeable to an extent of at least 80% to UV radiation.

282. As discussed above, Khramenkov in view of Jones renders obvious Claim 1, from which Claim 8 depends. While Jones does not disclose the extent of permeability of the multilayer film to UV radiation, a POSITA would have understood that in order for efficient UV curing of the reactive synthetic resin to occur, the internally situated multilayer film would need to be at least 80% permeable to UV radiation. Further, a POSITA would have been motivated to utilize a multilayer film with as high of a permeability to UV radiation as possible for the internally situated multilayer film to facilitate efficient UV curing of the reactive synthetic resin. As discussed above in Section VI.B, while optical

properties will vary with polymer chemical composition, blend, and density, polyolefin and polyamide-based films can achieve UV radiation transmission of greater than 80% within the UV spectrum. Further, as discussed above in Section VI.A, UV curing has been used in CIPP liners since the early 2000s. All inner tubular films used in UV curable CIPP liners since its use would have been required to a high level of UV radiation in order to cure efficiently. Therefore, Khramenkov in view of Jones teaches an insertion tube “wherein the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation is permeable to an extent of at least 80% to UV radiation.”

283. For at least these reasons, Khramenkov in view of Jones renders obvious Claim 8.

9. Claim 9

The insertion tube as claimed in claim 1, wherein the surface layer (a) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation is directly adjacent to the support material.

284. As discussed above, Khramenkov in view of Jones renders obvious Claim 1, from which Claim 9 depends. As discussed above in Section IX.B.1.c), layer (a) of the multilayer inner tubular film of Khramenkov in view of Jones is taught by Khramenkov to comprise “a mixture of polyethylene with polypropylene.” Further, as described above in Section IX.B.1.d), the multilayer film taught by Khramenkov modified by a POSITA in view of Jones comprises:

External layer (a): mixture of polyethylene with polypropylene (Khramenkov layer 8)

Internal layer (b): bonding layer, as taught by Jones

Internal layer (c): polyamide 12 or polyamide-based polymer adhesive (Khramenkov layer 7)

Internal layer (d): bonding layer, as taught by Jones

External layer (e): polyamide 6 (Khramenkov layer 6).

285. Khramenkov describes that the inner surface of the reinforcing tubular lining is formed from a thermoplastic layer:

according to the invention, before tubular films are placed outside a pipeline, a thermoplastic layer is placed on the surface of reinforcing tubular lining strongly bonded to the reinforcing tubular lining, which forms the inner surface of this lining and is in contact with inner tubular film,

EX1007 at p. 5, 1:16-22, emphasis added.

286. Khramenkov further describes the arrangement of the multilayer inner tubular film, 4, of its CIPP liner relative to the reinforcing tubular lining 2 with inner surface formed from thermoplastic layer 3:

The proposed method for applying tubular lining 1 (Fig. 1) onto the inner surface of a pipeline comprises the following: first, thermoplastic layer 3 strongly bonded to reinforcing tubular lining 2 being an internal surface of this tubular lining 2 made of synthetic polyester fiber felt and in contact with inner tubular film 4, is applied onto the surface of reinforcing tubular lining 2, and lateral end portions of reinforcing tubular lining 2 with lateral end portions of thermoplastic layer 3 are interconnected, outside the pipeline.

EX1007 at p. 6, 1:52-63, emphasis added.

287. Therefore, a POSITA contemplating Khramenkov would have understood thermoplastic layer 3 and the reinforcing tubular lining 2 to constitute the support material. The arrangement of the multilayer inner tubular film 4 relative to the support material, formed from reinforcing tubular lining 2 with an internal surface comprising thermoplastic layer 3, is shown below in Figure 18.

4 - Inner tubular film (6 + 7 + 8)

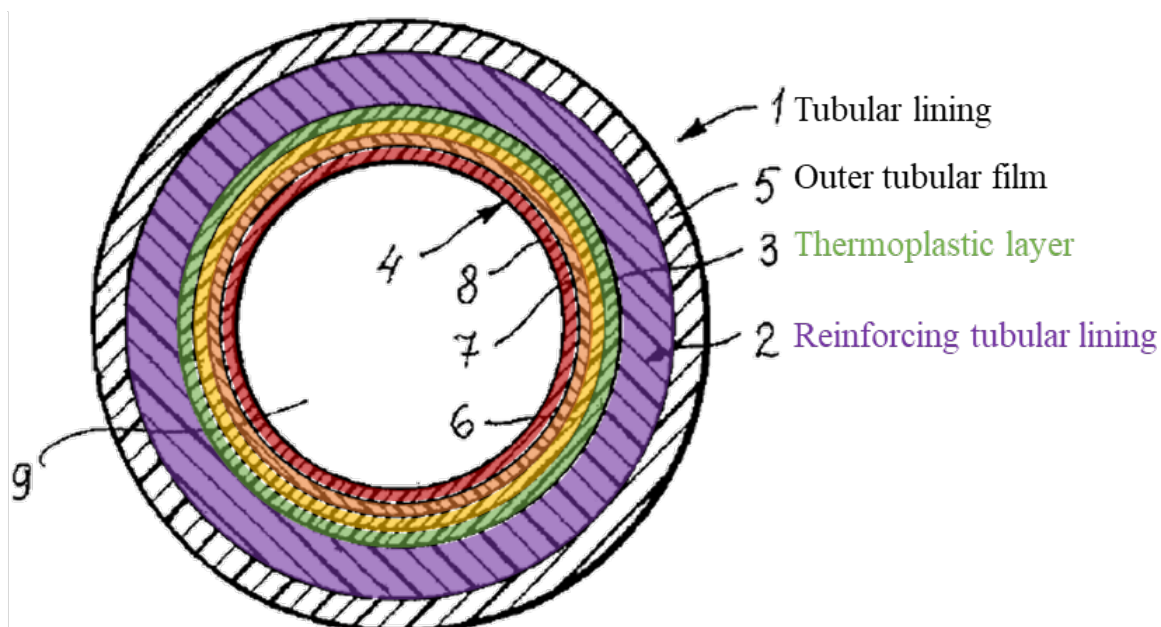


Fig. 1 6 - First outer layer of inner tubular film
 7 - Second intermediate layer of inner tubular film
 8 - Third inner layer of inner tubular film

Figure 18. Figure 1 of Khramenkov showing inner tubular film 4, comprising thermoplastic layers 6, 7, and 8, relative to the carrier material comprising reinforcing tubular lining 2 with an internal surface formed by thermoplastic layer 3. EX1007 at p. 2, Fig. 1, annotations added

288. As shown in Figure 18, layer 6 of Khramenkov (*i.e.*, layer (e) comprising polyamide 6) is directly adjacent to a thermoplastic layer 3, which is

strongly bonded to the carrier material 2 and forms “an internal surface of this tubular lining 2.” However, a POSITA considering Khramenkov in view of Jones would have found it obvious to try flipping the multilayer film to have external layer (a), comprising a mixture of polyethylene with polypropylene, adjacent to the support material (*i.e.*, reinforcing tubular lining 2 with thermoplastic layer 3 forming its internal surface) and layer (e), comprising a copolyamide, facing the interior of the CIPP liner.

289. It would have been obvious to a POSITA contemplating Khramenkov to consider Jones as both Khramenkov and Jones teach the use of insertion tubes for pipe renovation. EX1007 at p. 4, 1:1-8, EX1009 at p. 2, lns. 2-3. The one other available arrangement of the multilayer inner tubular film not disclosed by Khramenkov (*i.e.*, with the external layer (a) comprising a mixture of polyethylene with polypropylene against the carrier material) would have been obvious to a POSITA when considering Khramenkov because a POSITA would have known that polyolefins are known for their flexibility and elasticity, and are generally less stiff than polyamides. *See* Section VI.B. A POSITA would have known that having layer (a) comprising an olefin against the carrier material would allow the inner tubular film to stretch more with the carrier material to urge the carrier material against the inside surface of the host pipe during inflation of the CIPP liner during installation.

290. To the extent that it is argued that layer 3 and reinforcing tubular lining 2 are not integral components that constitute the support material, a POSITA would have found it obvious to remove thermoplastic layer 3, so that layer (a) of the inner tubular film would be directly adjacent to reinforcing tubular lining 2 (*i.e.*, the support material). A POSITA would have been motivated to remove thermoplastic layer 3 to eliminate the possibility of delamination of layer 3 after curing and subsequent removal of the inner tubular film. Delamination of thermoplastic layer 3 could obstruct the pipe.

291. Further, as discussed in Section VI.A, it has been known in the art since the 1970s to have the inner tubular film directly adjacent to the carrier material, as taught by Wood. Therefore, a POSITA would have been motivated to remove thermoplastic layer 3 with a reasonable degree of success. Further, a POSITA would have understood that the use of a thermoplastic layer between the inner tubular film and the resin impregnated support material would have been redundant. A POSITA would have been motivated to remove the redundant thermoplastic layer 3 in order to reduce manufacturing time and material cost, as the additional step of strongly bonding thermoplastic layer 3 to reinforcing tubular lining 2 would be removed. For at least these reasons, a POSITA would have been motivated to eliminate thermoplastic layer 3, resulting in the reoriented inner tubular film having its external layer (a) (Khramenkov layer 8 comprising a

mixture of polyethylene and polypropylene) directly adjacent to the support material, reinforcing tubular lining 2.

292. Therefore, Khramenkov in view of Jones teaches a multilayer film “wherein the surface layer (a) of the multilayer film that is impermeable to liquids and that is at least to some extent permeable to UV radiation is directly adjacent to the support material” and therefore renders obvious Claim 9.

10. Claim 10

A pipe-renovation system suitable for the renovation of subterranean pipes, comprising an insertion tube as claimed in claim 1, provided for introduction into the pipe requiring renovation, and a source that emits UV radiation and/or short wave, visible light, and that is optionally moveable.

293. As discussed above, Khramenkov in view of Jones renders obvious Claim 1, from which Claim 10 depends. Khramenkov states that “It is an object of the present invention to provide a method for applying a tubular lining onto the inner surface of a pipeline...” EX1007 at p. 4, 2:57-59. Therefore, Khramenkov teaches an insertion tube “provided for introduction into the pipe requiring renovation.”

294. Further, Jones teaches that the reactive resin impregnated into the fibrous mat can be cured through ultra-violet light. EX1009 at p. 2, lns. 7-9, *see also*, EX1009 at p. 3, lns. 26-28. Therefore, while Jones does not explicitly disclose the use of “a source that emits UV radiation and/or short wave, visible

light, and that is optionally moveable” a POSITA would have understood that the use of such a light source would be required to activate the light activatable catalyst used in the reactive resin to efficiently cure the CIPP liner of Jones. For example, as discussed above in Section VI.A, UV light trains were well known light sources that move through inflated CIPP liners during installation to cure the reactive resin. Therefore, Jones discloses “a source that emits UV radiation and/or short wave, visible light, and that is optionally moveable.”

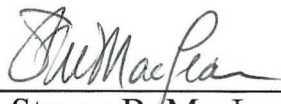
295. Khramenkov in view of Jones therefore teaches an insertion tube “for introduction into the pipe requiring renovation, and a source that emits UV radiation and/or short wave, visible light, and that is optionally moveable” and renders obvious Claim 10.

X. CONCLUSION

296. In this report, I have presented my opinions regarding the invalidity of Claims 1-10 of the '269 Patent based on the information available to me. My analysis of the materials produced in this case is ongoing. As new material is presented to me, I will continue my review of such material. Therefore, this report represents only those opinions I have formed to date. In the event I receive additional information, including opinions proffered by Buergofol or its expert, I reserve the right to revise, supplement, and/or amend my opinions accordingly.

297. I hereby declare that all statements made herein of my own knowledge are true, that all opinions expressed herein are my own, and that all statements made on information and belief are believed to be true and correct; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

298. I declare under penalty of perjury that the foregoing is true and correct.

Dated: September 20, 2023 By: 
Steven B. MacLean