

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

COMMSCOPE TECHNOLOGIES LLC.
Petitioner

v.

BELDEN INC.
Patent Owner

Case IPR _____
U.S. Patent No. US 6,570,095
Issued: May 27, 2003
Filed: May 11, 2001

DECLARATION OF KENNETH CORNELISON

In Support of *Inter Partes* Review of U.S. Patent No. 6,570,095

I, Kenneth Cornelison, declare as follows.

I. INTRODUCTION

1. I have been retained by Petitioner, CommScope Technologies LLC, (“CommScope” or “Petitioner”) to provide expert opinions in connection with a petition for *inter partes* review before the United States Patent and Trademark Office. I understand that this declaration involves my expert opinions and expert knowledge related to U.S. Patent No. 6,570,095 (“the ’095 Patent”), titled “Multi-Pair Data Cable with Configurable Core Filling and Pair Separation,” and its field of endeavor.

2. I have been asked to provide my independent technical review, analysis, insights, and opinions regarding the ’095 Patent and the references that form the basis for the grounds of unpatentability set forth in the Petition for *Inter Partes* Review of the ’095 Patent. The statements made herein are based on my own knowledge and opinions.

II. SUMMARY OF OPINIONS

3. To summarize the opinions stated herein, it is my opinion that the claims of the ’095 patent are invalid based on the following grounds:

	Claims	Basis for Unpatentability
Ground 1	27-29	Anticipated by Roberts
Ground 2	30-33	Obvious in view of Roberts , one or more of Jachimowicz and Gingue, and/or the knowledge of a POSITA

Ground 3	27-29	Anticipated by GmbH-866
Ground 4	30-33	Obvious in view of GmbH-866 , one or more of Jachimowicz and Gingue, and/or the knowledge of a POSITA
Ground 5	27-33	Obvious in view of Roberts, one or more of GmbH-866, Jachimowicz, and Gingue, and/or the knowledge of a POSITA.
Ground 6	27-33	Obvious in view of GmbH-866, one or more of Roberts, Jachimowicz, and Gingue, and/or the knowledge of a POSITA.
Ground 7	27-29	Anticipated by Yanagida
Ground 8	30-33	Obvious in view of Yanagida , one or more of Jachimowicz and Gingue, and/or the knowledge of a POSITA

4. In this declaration, I provide various annotated figures to aid in explaining my opinions. However, these figures are not intended to necessarily imply literal, precise physical or bodily combination or modification in exactly or only the way shown or annotated. Instead, I provide those figures only to help illustrate various concepts, and they should not be taken as showing the only disclosure of a particular element, or the only way that a person of ordinary skill in the art would have been motivated to modify or combine references.

III. QUALIFICATIONS

5. I have 40+ years of experience in the wire and cable industry. My experience includes the design, development and testing of high-speed data cables. I obtained my BSEE in 1974 and I started working in the wire and cable industry in 1976. Through the late 1970s through the 2000s, I worked in the design,

manufacturing and testing of wires and cables for companies including Anaconda, Alcatel, Belden and General Cable. My roles included being manager of product development and customer engineering, process development manager, and VP of Technology – Data Communications. Since leaving General Cable, I have consulted in the wire and cable industry, published several papers, given technical training and been actively involved in the International Wire and Cable Symposium (IWCS). The IWCS promotes, initiates, and coordinates the exchanging of technical information on wire, cable and fiber optics within industry and the government, through an annual IWCS Symposium. I have been an instructor (or co-instructor) at the annual Symposiums held in 2013, 2014, 2015, 2016, 2018, 2019, 2022, and am currently expecting to be an instructor at the Symposium planned for 2023. I am a named inventor on more than 15 US patents.

6. I am being compensated for my time at the rate of \$175 per hour for time spent on this matter. I have no interest in the outcome of this proceeding, and my compensation is not dependent upon the outcome of this proceeding.

IV. MATERIALS CONSIDERED

7. My technical review, analysis, insights, and opinions are based on my experience and other qualifications discussed above, as well as my study of relevant materials.

8. I have reviewed and am familiar with the '095 patent specification, claims, prosecution history, and *inter partes* reexamination.

9. I have also reviewed and am familiar with each exhibit cited herein. I confirm that to the best of my knowledge the accompanying exhibits are true and accurate copies of what they purport to be, and that an expert in the field would reasonably rely on them to formulate opinions such as those set forth in this declaration.

Exhibit No.	Exhibit Description
1001	U.S. Patent No. 6,570,095 (the “ ’095 patent ”)
1002	Excerpt of Prosecution History of U.S. Patent No. 6,570,095: Nov. 8, 2002 Notice of Allowance
1003	Excerpt of <i>Inter Partes</i> Reexamination No. 9,500,474 of U.S. Patent No. 6,570,095: Sept. 20, 2011 Action Closing Prosecution
1004	U.S. Patent No. 6,998,537 (the “ ’537 patent ”)
1005	Excerpt of Prosecution History of U.S. Patent No. 6,998,537: Nov. 2, 2004 Notice of Allowance
1006	Excerpt of <i>Inter Partes</i> Reexamination No. 9,500,476 of U.S. Patent No. 6,998,537: Sept. 20, 2011 Action Closing Prosecution
1007	[Present] Declaration of Kenneth Cornelison
1008	<i>Curriculum Vitae</i> of Kenneth Cornelison
1009	U.S. Patent No. 3,622,683 (“ Roberts ”)
1010	Translation of German Patent No. 297,19,866 U1 (“ GmbH-866 ”)
1011	German Patent No. 297,19,866 U1
1012	Japanese Patent No. Sho43(1968)-15470 (“ Yanagida ”)
1013	U.S. Patent No. 5,670,748 (“ Gingue ”)
1014	U.S. Patent No. 3,894,172 (“ Jachimowicz ”)
1015	U.S. Patent No. 4,755,629 (“ Beggs ”)

1016	<i>Electronic Wire & Cable - A User's Guide: Performance and Selection</i> , Section 5: Multiconductor Cables, AT&T (1987)
1017	Whitham D. Reeve, <i>Subscriber Loop Signaling and Transmission Handbook – Digital</i> , IEEE Telecommunications Handbook Series (1995)
1018	Whitham D. Reeve, <i>Subscriber Loop Signaling and Transmission Handbook – Analog</i> , IEEE Telecommunications Handbook Series (1992)
1019	U.S. Patent No. 5,380,591
1020	U.S. Patent No. 1,727,972
1021	U.S. Patent No. 1,956,730
1022	U.S. Patent No. 3,803,340 (“Jachimowicz-340”)
1023	Canadian Patent Application No. 2,058,046
1024	U.S. Patent No. 4,262,164
1025	U.S. Patent Pub. No. 2006/0169478
1026	U.S. Patent No. 4,253,890
1027	U.S. Patent No. 5,283,390
1028	U.S. Patent No. 5,969,295
1029	G.F. Moore, <i>Electric Cable Handbook</i> , BICCCables (3d. ed. 1997)
1030	<i>The New IEEE Standard Dictionary of Electrical and Electronics Terms</i> (5th ed. 1993)
1031	Neil Sclater and John Markus, <i>Electronics Dictionary</i> , McGraw-Hill (6th ed. 1997)
1032	S. Yonechi et al., <i>Application of Spacer Forming Technique to Communication Cables</i> , International Wire & Cable Symposium Proceedings (1980)
1033	U.S. Patent No. 7,179,999 (the “’999 patent”)
1034	Excerpt of <i>Inter Partes</i> Reexamination No. 9,500,475 of U.S. Patent No. 7,179,999: Oct. 14, 2011 Action Closing Prosecution
1035	Alcatel Cable Systems Product Catalog ¹

¹ This Alcatel Cable Systems product catalog I acquired in approximately 1989 or 1990 and that I have had in my possession since that time. This catalog was publicly available and distributed by Alcatel during my employment with Alcatel Cable Systems, which was in the 1988-1992 time period.

1036	U.S. Patent No. 5,789,711
1037	Excerpt of Prosecution History of U.S. Patent No. 6,570,095: Oct. 22, 2001 Non-Final Office Action
1038	Excerpt of Prosecution History of U.S. Patent No. 6,570,095: April 3, 2002 Final Office Action
1039	Excerpt of Prosecution History of U.S. Patent No. 6,998,537: March 3, 2004 Non-Final Office Action
1040	Excerpt of Prosecution History of U.S. Patent No. 6,998,537: Terminal Disclaimer
1041	Excerpt of Prosecution History of U.S. Patent No. 6,998,537: May 18, 2004 Amendments
1042	Excerpt of Prosecution History of U.S. Patent No. 6,998,537: June 17, 2004 Final Office Action
1043	Excerpt of Prosecution History of U.S. Patent No. 6,998,537: September 20, 2004 Request for Continued Examination
1044	Excerpt of Prosecution History of U.S. Patent No. 6,998,537: Sept. 9, 2005 Amendment
1045	Excerpt of <i>Inter Partes</i> Reexamination No. 9,500,474 of U.S. Patent No. 6,570,095: Feb. 24, 2012 Decision Granting Petition to Terminate <i>Inter Partes</i> Reexamination Proceeding
1046	Excerpt of <i>Inter Partes</i> Reexamination No. 9,500,476 of U.S. Patent No. 6,998,537: Feb. 24, 2012 Decision Granting Petition to Terminate <i>Inter Partes</i> Reexamination Proceedings
1047	Excerpt of <i>Inter Partes</i> Reexamination No. 9,500,475 of U.S. Patent No. 7,179,999: Feb. 24, 2012 Decision Granting Petition to Terminate <i>Inter Partes</i> Reexamination Proceedings
1048	U.S. Patent No. 5,814,768
1049	U.S. Patent No. 6,037,546
1050	Excerpt of <i>Inter Partes</i> Reexamination No. 9,500,474 of U.S. Patent No. 6,570,095: Jan. 11, 2010 Third Party Requester's Comments to Patent Owner's Response
1051	Excerpt of <i>Inter Partes</i> Reexamination No. 9,500,476 of U.S. Patent No. 6,998,537: Jan. 22, 2010 Third Party Requester's Comments to Patent Owner's Response
1052	<i>Belden Techs. Et al. v. Superior Essex Comm'cns LP et al.</i> , No. 08-63, Dkt. 215 at 1 (D. Del. Aug. 8, 2010) – Claim Construction Order
1053	Scheduling Order, C.A. No. 22-783-RGA (D. Del.)

1055	Yanagida Translation from Inter Partes Reexaminations
1056	Japanese Patent Publication No. S43-15470 (untranslated original)
1057	English language translation of German Patent No. 297,19,866 U1 used in prior reexamination of US 6,998,537

All citations to exhibits are to the bates number stamped at the bottom of the page except for patent and patent publications, which are cited to their column and line numbers.

V. RELEVANT LEGAL PRINCIPLES

A. Effective Filing Date

10. I understand that claims of a patent have an “effective filing date” and that obviousness is considered based on the prior art as of that date.

11. The utility application for '095 patent (application No. 09/853,512) was filed on May 11, 2001. It is a continuation of application No. 09/257,844, filed on February 25, 1999, now U.S. Patent No. 6,248,954. Therefore, I am told that for the purposes of this proceeding, I have been asked to use February 25, 1999 as the effective filing date for the challenged claims.

B. Person of Ordinary Skill in the Art

12. I have been informed that a person of ordinary skill in the art (“POSITA”) is a person who is presumed to have complete knowledge of the relevant prior art and who would think along the lines of conventional wisdom in that art. The person of ordinary skill in the art has ordinary creativity and does not

have extraordinary skill, e.g., is not an expert. I have been informed that factors to consider in determining the level of ordinary skill in the art include the educational level of workers in the field, the types of problems addressed in the art, prior-art solutions to such problems, how quickly innovations are made, and the complexity of the technology.

13. The '095 patent relates to data communication cables. Generally speaking, the '095 patent is directed to cables that include a plurality of twisted pairs and techniques to improve crosstalk. *See* EX-1001 at Title, Abstract, 2:60-64. In view of the factors mentioned above and the discussion of the technical background herein, it is my opinion that a person of ordinary skill in the art of the '095 patent would have had a bachelor's degree in electrical engineering and a minimum of 3-4 years of industry experience in connection with designing, manufacturing, and testing of twisted-pair data cables. An individual with a master's degree in electrical engineering would require less industry experience (e.g., 1-2 years).

14. Throughout my declaration, even if I discuss my analysis in the present tense, I am always making my determinations based on what a POSITA would have known as of the effective date (here February 25, 1999).

C. Claim Construction Standard

15. I have been instructed by counsel on the law regarding claim construction and patent claims, and understand that a patent may include two types of claims—independent claims and dependent claims. An independent claim stands alone and includes only the features it recites. A dependent claim can depend from an independent claim or another dependent claim. I understand that a dependent claim includes all the features that it recites in addition to all of the features recited in the claim from which it depends.

16. In an *inter partes* review proceeding such as this, I understand the claim of a patent shall be construed using the same claim construction standard that would be used to construe the claim in a civil action. I understand this includes construing the claim in accordance with the ordinary and customary meaning of such claim in view of the specification and the prosecution history pertaining to the patent, as understood by one of ordinary skill in the art. For completeness, I understand this standard is different from the prior “broadest reasonable interpretation” standard that was used in certain earlier *inter partes* reexamination proceedings.

17. I understand an appropriate dictionary definition may provide evidence explaining the ordinary and customary meaning as would be understood by a person of ordinary skill in the art.

18. I understand that if there are specific statements in the specification that define the invention with respect to a term, those statements are strong evidence of a definition for the term.

D. Anticipation and Obviousness Law

19. In this declaration I have been instructed by counsel on the law regarding anticipation and obviousness. I understand that a claim is invalid if it is anticipated or obvious. My opinions here relate to both anticipation and obviousness as detailed below.

1. Anticipation

20. I understand that anticipation of a claim requires that every element of a claim is expressly or inherently disclosed in a single prior art reference. I understand that an anticipating reference need not use the exact terms of the claims, but must describe the patented subject matter with sufficient clarity and detail to establish that the claimed subject matter existed in the prior art and that such existence would be recognized by persons of ordinary skill in the field of the purported invention. I also understand that an anticipating reference must enable one of ordinary skill in the art to reduce the purported invention to practice without undue experimentation. Under what is known as inherency, I understand that if the prior art necessarily functions in accordance with, or includes the claimed limitations, it anticipates. I also understand that I may examine evidence that is

outside of the prior art reference in determining whether a feature, while not expressly discussed in the reference, is necessarily present in that reference.

2. Obviousness

21. I understand that a patent claim is also invalid if the claims would have been obvious to a POSITA at the time of the invention. I understand that the obviousness inquiry should not be done in hindsight but rather from the perspective of a POSITA as of the time of the invention.

22. I understand that to obtain a patent, the claims must have been, as of the time of the invention, nonobvious in view of the prior art. I understand that an obviousness analysis involves comparing a claim to the prior art to determine whether the claimed invention would have been obvious to a POSITA at the time of the invention in view of the prior art and in light of the general knowledge in the art as a whole. I also understand that obviousness is ultimately a legal conclusion based on underlying facts of four general types, all of which must be considered:

- (1) the scope and content of the prior art;
- (2) the level of ordinary skill in the art;
- (3) the differences between the claimed invention and the prior art;
- and
- (4) any objective indicia of nonobviousness.

23. I understand that a claim is obvious when the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a POSITA at the time of the invention.

24. I understand that certain objective indicia can be important evidence regarding whether a patent is obvious. Such indicia include: industry acceptance; commercial success of products covered by the patent claims; long-felt need for the invention; failed attempts by others to make the invention; copying of the invention by others in the field; unexpected results achieved by the invention as compared to the closest prior art; praise of the invention by the infringer or others in the field; taking of licenses under the patent by others; expressions of surprise by experts and those skilled in the art at making the invention; and the patentee proceeded contrary to the accepted wisdom of the prior art. I understand that such evidence must have a nexus, or causal relationship to the elements of the claim. I am unaware of any such objective considerations having a nexus to the claims at issue in this proceeding.

25. I understand that obviousness can be established by combining multiple prior art references to meet each and every claim element, or by modifying a single prior art reference.

26. I understand that that a showing of obviousness requires that, as of the patent's effective filing date, (1) a POSITA would have been motivated to combine prior art references to arrive at the claimed subject matter and (2) there would have been a reasonable expectation of success in achieving the claimed invention from such combination.

27. I also understand that to support a combination of multiple prior art references or a modification of a single reference, there must be a rationale explaining why a skilled artisan would combine or modify the references in the manner claimed and how the proposed combination or modification meets each and every claim element. This rationale may come from a teaching, suggestion, or motivation to combine. However, I understand that a specific teaching, suggestion, or motivation to combine elements in the prior art to achieve the claimed combination is not required for obviousness. Instead, I understand that a combination of known elements may be obvious in light of the interrelated teachings of the prior art, the effects of demands in the market, the background knowledge possessed by a POSITA, and inferences and creative steps that a POSITA would employ. But I also understand that a proposed combination or modification of references can be susceptible to hindsight bias. When it appears hindsight bias is being used, I understand the modification or combination is not considered obvious.

28. I understand that exemplary rationales that may support a conclusion of obviousness include: combining or modifying prior art elements according to known methods to yield predictable results; simple substitutions of one known element for another to obtain predictable results; using a known technique to improve similar devices in the same way; applying a known technique to a known device ready for improvement to yield predictable results; 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 are predictable to one of ordinary skill in the art; and 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 teachings to arrive at the claimed invention.

29. I understand that teaching away, e.g., discouragement from making the proposed modification, is strong evidence that the references are not combinable. I also understand that a disclosure of more than one alternative does not necessarily constitute a teaching away.

30. I understand that the combination does not need to result in the most desirable embodiment, but if the proposed combination does not have a reasonable

expectation of success at the time of the invention, a POSITA would not have had an adequate teaching, suggestion, or motivation to combine the references.

31. I understand that the test for obviousness is not whether the features of a secondary reference may be bodily incorporated or physically combined into the structure of the primary reference, but whether the claimed invention is rendered obvious by the teachings of the references as a whole.

VI. Technology Overview

32. The '095 Patent relates to data communications cables. '095 Patent at Abstract. Data communications cables were typically constructed of twisted pairs of insulated metal conductors (e.g., wires). *E.g.*, EX-1029 at 23 (“Twisted Pair Data Cables”), 25 (“Cables with twisted pairs are used where balanced signal transmission is required, together with low crosstalk”), 33 (Fig. 55.1: cross-section of telecommunication twisted pair cable); EX-1017 at 11 (“The most commonly used transmission media in present-day digital loop applications is twisted pair metallic (copper) cable”); EX-1016 at 7 (“Most of the cables within the scope of AT&T’s EC&W product line utilize the twisted pair construction.”).

A. Twisted Pairs

33. Twisted pairs were (and are) commonly referred to as simply “pairs” in the industry. *See, e.g.*, EX-1017 at 18 (“Each cable pair consists of two twisted insulated conductors.”). Each of the conductors of a twisted pair is typically

wrapped in an insulating material, commonly a polymeric material. This was well known at the time the priority application was filed, February 25, 1999. *See, e.g.*, EX-1019 at 1:10-12 (filed Dec. 30, 1992; “A typical telephone cable is constructed of twisted pairs of metal conductors for signal transmission. Each conductor is insulated with a polymeric material.”). A number of twisted pairs were then assembled into a cable and wrapped in a polymeric sheath or jacket. *Id.* at 1:12-16; *see also* EX-1016 at 7 (“Production of small cables of this type involves twisting individual pairs and grouping those twisted pairs to form either a cable or a unit for a larger cable.”).

34. Twisted pairs have been a staple of the cable industry for over a century. For example, telephone cable patents from the 1920s discuss using twisted pairs in electrical cables. *See, e.g.*, EX-1020 at 2:55-57 (U.S. Patent No. 1,727,972 filed April 18, 1924; “A plurality of copper wires insulated with paper, cotton, silk, or other suitable materials, usually twisted together in pairs”); EX-1021 at 1:43-47 (U.S. Patent No. 1,956,730 filed Sept. 11, 1929; “assembling and twisting a plurality of twisted pairs of individual insulated electrical conductors into a single compact group or so called cable unit”).

35. When compared to untwisted pairs, twisted pairs have improved crosstalk and decreased unbalanced mutual capacitance. EX-1016 at 7 (“The two main reasons for twisting pairs of conductors are to minimize or eliminate

crosstalk and to decrease unbalanced mutual capacitance.”). Certain electrical parameters, such as wave impedance, are dependent on the spacing of the two conductors. Twisting the two conductors maintains consistent spacing between the two conductors along the length of the pair. The twisting also causes periodic reversals in the electrical field that surrounds the pair. These reversals also result in improved isolation from electrical fields produced by adjacent pairs or outside electrical fields. Twisted pairs also have a mechanical advantage in that the individual wires stay together, and the individual wires of the pair do not become intermixed.

B. Crosstalk

36. Crosstalk was a well-known issue associated with data communication cables at the time the priority application was filed. *See, e.g.*, EX-1014 at 1:8-16, *see also* EX-1022 at 1:8-16. Crosstalk can refer to crosstalk between adjacent pairs or groups of pairs, or crosstalk between adjacent cables. Crosstalk between pairs or groups of pairs was known to occur when a signal is transmitted over a first twisted pair—commonly referred to as a disturbing circuit—and that signal induces currents and electromotive forces in another twisted pair—referred to as the disturbed circuit. EX-1009 at 3:21-28; *see also* EX-1022 at 1:7-10. This results in the disturbed circuit carrying two signals: (1) the information signal intended for transmission and (2) the unwanted signal induced

by the disturbing pair. EX-1022 at 1:10-14. The unwanted signal is superimposed over the intended signal reducing the clarity and reliability of the transmission. *Id.* at 1:10-16. Crosstalk between cables was known to occur where one cable induces disturbing currents in an adjacent cable (sometimes referred to as alien crosstalk).

37. There are multiple types of crosstalk. One is near-end crosstalk. This is crosstalk that occurs when a twisted pair (or group of twisted pairs) transmitting in one direction causes crosstalk on a nearby twisted pair (or group of twisted pairs) transmitting in the opposite direction).² This happens because the signal being transmitted out from one end (originating at the near-end) would be relatively stronger than the signal being received at that near end, because the received signal originated at the far-end and signal strength is diminished as it travels through the cable.

38. Far-end crosstalk occurs when there is crosstalk between twisted pairs transmitting in the same direction.³ To prevent far-end crosstalk, cable designers added a metal containing layer around individual twisted pairs. *See* EX-1010 at 2.

² EX-1030 at 5 (“near-end crosstalk. Crosstalk that is propagated in a disturbed channel in the direction opposite to the direction of propagation of the current in the disturbing channel. *Note:* the terminal of the disturbing channel at which the near-end crosstalk is present is ordinarily near to or coincides with the energized terminal of the disturbing channel.”).

³ EX-1030 at 4 (“far-end crosstalk. Crosstalk that is propagated in a disturbed channel in the same direction as the direction of propagation of the current in the

39. Prior to 1999, there were various known ways to reduce crosstalk between adjacent pairs or groups of pairs. For example, the twist lengths of the twisted pairs may be varied to prevent the electrical fields surrounding each pair from being in unison along their length and therefore more strongly influence the other. The twist lengths of the twisted pairs may also be varied to prevent the twisted pairs from nesting together. EX-1014 at 1:30-34. Nesting results when the circles circumscribing each twisted pair overlap with each other resulting in closer proximity from pair to pair and stronger crosstalk between the pairs. *See, e.g.*, EX-1015 at 6:57-7:3, Fig. 8A. Preventing the twisted pairs from nesting together reduces crosstalk.

40. Another known way to reduce crosstalk was to physically separate a twisted pair or set of twisted pairs from each other such that voltage induced by the disturbing pair on the disturbed pair is decreased. The crosstalk was known to be reduced to acceptably low levels by having the physical barrier, which prevented the twisted pairs from nesting with each other. *See, e.g.*, EX-1015 at 6:57-7:3, Figs. 8A. Crosstalk was also known to be reduced to acceptably low levels by the physical barrier creating and maintaining a certain minimum physical distance between twisted pairs. *E.g.*, EX-1015 at 3:48-51 (“As a result of the physical

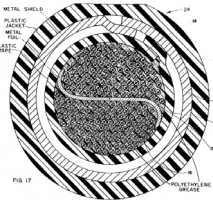
disturbing channel. The terminal of the disturbed channel at which the far-end crosstalk is present and the energized terminals of the disturbing channel are ordinarily remote from each other.”).

separation of the conductor pairs and the maintenance of the twist configuration of each pair, crosstalk performance is improved”), 7:58-60 (“The portions of the buffer system maintain the conductor pairs spaced apart which improves crosstalk performance”); EX-1023 at 3:17-31. Increasing the distance between adjacent twisted pairs was understood to effectively decrease the crosstalk. *E.g.*, EX-1023 at 3:17-31.

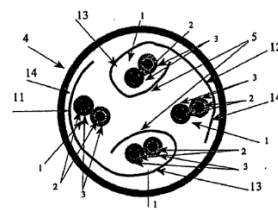
C. Separators/Buffers Between Twisted Pairs or Groups of Twisted Pairs Within a Data Communications Cable

41. Various physical barriers/buffers/separators between twisted pairs or groups of twisted pairs in data communications cables were known and used in the art by 1999 and long before. Such separators were often made of dielectric materials or dielectric-coated materials.

42. For example, some were made purely of plastics/polymers. *See, e.g.*, EX-1015 at Figs. 6, 7 and 5:64-6:14; EX-1012 at Figs. 1, 2; EX-1023 at Figs. 2, 3; EX-1036 at Fig. 1. Others were plastic-coated metallic tapes. *See, e.g.*, EX-1009, EX-1010, EX-1022, EX-1017, EX-1018. Common plastic coatings included an olefin polymer such as polyethylene, polypropylene, polyethylene terephthalate (Mylar), or other plastic material. *See, e.g.*, EX-1009 at 3:32-37. Some examples of physical separators in the prior art for separating twisted pairs in data communications cables are shown below:

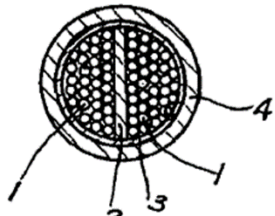


EX-1009, Fig. 17 – plastic-coated metal tape separator

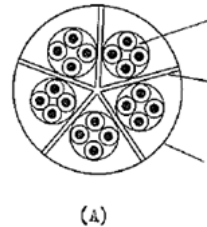


Figur 1

EX-1010, Fig. 1 – plastic-coated metal tape separators

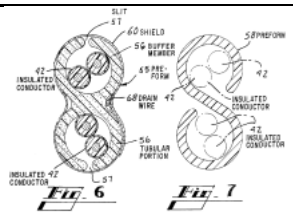


EX-1012, Fig. 1 – plastic separator

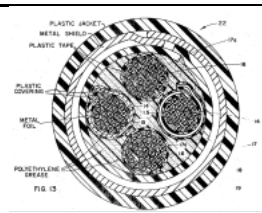


(A)

EX-1032, Fig. 3 –polyester tape separators



EX-1015, Figs. 6, 7 and 5:64-6:14, 6:52-56 – foamed polymer and/or dielectric tape separators



EX-1009, Fig. 13 – plastic tape-only separator (17a)

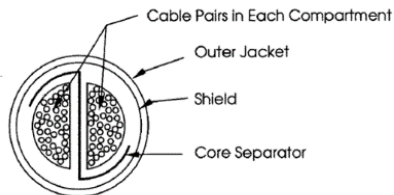
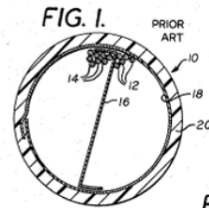


Figure 3-1 Compartmental core cable cross-section

EX-1017, Fig. 7-7 – core separator (See also EX-1018, Fig. 3-1)



F

EX-1022, Fig. 1 – Z-screen separator

43. It was known that separators worked to reduce crosstalk to acceptably low levels even without completely surrounding the twisted pair (or group of twisted pairs). *See, e.g.*, EX-1010; EX-1009; EX-1015 at Fig. 7; EX-1032 at Fig. 3.

D. Dielectrics

44. In the data communications field, it was commonly known that a “dielectric” material was often used in cable constructions as an insulator, as dielectrics had poor (or very low) electrical conductivity. One industry dictionary defines a dielectric as: “Another term for an insulator or material that has poor electric conductivity. Dielectrics such as air, mica, paper, plastic film, or ceramic separate the metal foil or metallized plates in a capacitor to isolate them electrically . . .” EX-1031 at 4. A POSITA would understand that an insulator is a dielectric material, and that plastic/polymer is a dielectric material. *Id.*

45. Specifically, olefin polymers such as polyethylene and polypropylene were known to have very low dielectric constants. EX-1013 at 2:10-13. It was also known that foaming a polymer resulted in a material with an even *lower* dielectric constant, as foaming adds air (which has the lowest dielectric constant) to the material. *E.g.*, EX-1013 at 3:20-26. Polyester layers were also known to be good

dielectrics with low dielectric constants. An example of a common polyester used in cabling was Mylar.

E. Foamed Polymers as Buffers/Barriers/Isolating Members In Data Communications Cables

46. By 1999, the beneficial properties of foamed polymer, in particular, as an isolating/protective layer in communications cables were well-known. The art explained that foaming a polymer (expanding it by adding air pockets) was known to both further “optimize the electrical characteristics (i.e., the dielectric constant and dissipation factor) of the material” and also “decrease the amount of flammable material employed for a given volume of material.” EX-1013 at 4:5-9, 3:20-26. As the art taught, “a foamed material is preferably employed to achieve a favorable balance of electrical properties and flame retardancy.” *Id.* at 3:23-25. Given this, foamed polymer was commonly used as an isolating/insulating layer in data communications cables. *Id.* at Abstract; EX-1014 at 2:46-59 (teaching using a foamed polymer tape (such as foamed polyethylene backed by Mylar) to beneficially hold twisted pairs together and separate the pairs from a metal shield); EX-1010 at 2 (teaching a “foam-skin polyethylene” insulation for a cable conductor wire).

47. Separating twisted pairs using a foamed polymer, specifically, was also known by 1999. *E.g.*, EX-1015 at Fig. 6 and cl. 19 (a “buffer” of foamed PVC separating twisted pairs).

48. Foaming reduces the dielectric constant of a material (thereby enhancing electrical performance) because it traps air, which has a very low dielectric constant, in the material. A low dielectric constant results in lower capacitance between metal conductors (at the same conductor separation), resulting in lower transmission loss. Capacitors form when two conductors are separated by a dielectric material. For example, capacitance may occur between twisted pairs on opposite sides of a non-metal separator or between a twisted pair and a metal layer within the separator. When an alternating current is applied to the conductor, some current will flow through the capacitor resulting in some current loss (i.e., transmission loss). Providing a foamed polymer barrier was known to effectively lower the dielectric constant of the capacitor that formed in the cable, increasing the efficiency of the data transmission.

F. Shielding

49. Material with one or more conductive layers often was (and is) used in data communications cables and at the time was referred to as a shield or shielding. For example, a metal tape (or plastic-coated metal tape) was wrapped around a cable assembly with the conductive layer grounded (e.g., with a ground wire) to dissipate unwanted currents and create an electromagnetic shield around the wrapped assembly. These shields could be either around or between each individual twisted pair or groups of pairs within a cable assembly, or around the

cable assembly (e.g., within or next to the cable jacket), or both. Such shielding between twisted pairs or groups of twisted pairs was known to help reduce crosstalk by electrically isolating either twisted pairs or groups of twisted pairs from one another or cables from one another. *E.g.*, EX-1015 at 2:54-66 (“Shielding often is added to a twisted pair of insulated conductors to confine its electric and magnetic fields. In this way, susceptibility to electromagnetic interference is reduced.”).

50. However, it was understood that acceptably low levels of crosstalk could be achieved, for example between adjacent twisted pairs, without using metal-containing separators or shields, and that there were known tradeoffs associated with using a shield around each twisted pair. *E.g.*, EX-1015 at 2:54-66 (“However, as the electric and magnetic fields are confined [by a metal-containing shield], resistance, capacitance and inductance all change, each in such a way as to ***increase transmission loss***. . . . In order to compensate for the increased losses, the conductor insulation must be increased in thickness.”) (emphasis added); 9:33-37 (“crosstalk performance of the cable 20 is somewhat less than for multiple coaxial cable, or in cables having individually shielded pairs, but it is acceptable in a cable which meets stringent size requirements”).

G. Twisting Cable Components About a Common Axis (Also Known as “Cabling”)

51. By 1999, it was common practice to twist cable components about a common axis. *See, e.g.*, EX-1009 at 11:70-12:38, Fig. 23; EX-1014 at 3:2-11, 3:18-24, 3:41-42, cl. 1, 2:4-5, Fig. 4; EX-1010 at 5-6; EX-1016 at 9-10. This common technique was also known as “cabling” the components of a cable together, to create the finished assembly. Twisting a cable about a common axis was known to be generally desirable and beneficial because it increased the strength and flexibility of the finished cable and also improved impedance uniformity.

52. For example, twisting cable components about a common axis was known to be the most effective way to avoid issues resulting from the difference between the inside and outside diameters of the cable. When cables bend, it is preferred that the stresses on the twisted pairs within the cables are the same independent of whether the twisted pair is on the inside of a bend or on the outside of a bend. A twisted pair at the outside of a bend is subjected to tensile stress which could result in mechanical deformation. A pair at the inside of a bend is subjected to compression stress, which can also cause mechanical deformation such as buckling. The signals transmitted over that twisted pair may be degraded. With a stranded cable, the twisted pair will behave somewhat as a spiral spring and

reduce mechanical stress since the pairs are sometimes on the outside and sometimes on the inside, which eliminates this issue.

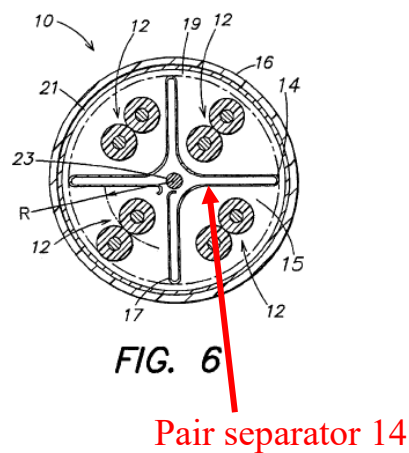
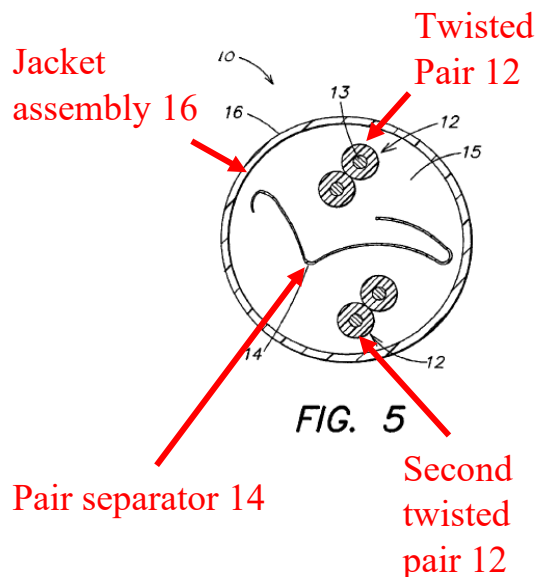
53. Further, cables having all their components twisted (stranded or cabled) about a common axis cables were known to be less stiff and easier to bend than straight cables since the pairs have less tensile and compression stress. For example, a spring made out of the same wire is more flexible than the wire itself. The helix in the wire is a spring like structure. The tensile and compression stresses can cause the individual conductors of the pairs to separate if the pairs are not twisted (cabled) about a common axis. This can result in degraded crosstalk performance and low return loss. Stranding everything together avoids this risk.

VII. THE '095 PATENT

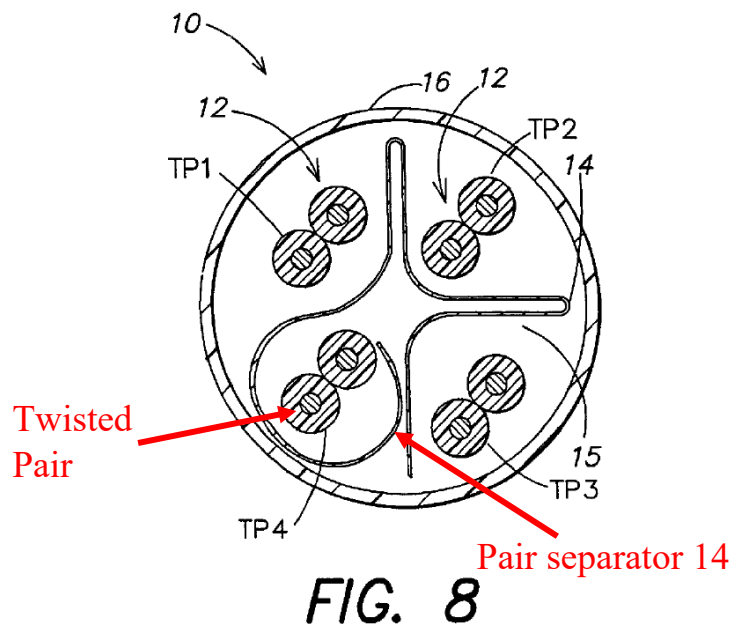
54. The '095 Patent describes a data communications cable with a plurality of twisted pairs and a pair separator 14 within a jacket assembly 16. EX-1001 at Abstract, 4:60-5:6. The pair separator 14 separates the twisted pairs from each other to provide “a desired crosstalk isolation between each of the plurality of twisted pairs.” *Id.* at Abstract; *see also id.* at 4:60-5:6. The pair separator 14 is configured to form grooves along a longitudinal length for the twisted pairs to be disposed within. *Id.* The pair separator 14 and twisted pairs 12 are twisted together prior to the application of the jacket. *Id.* at 9:5-12.

55. The pair separator 14 is “preferably a flame-retardant, low-dielectric constant, low-dissipation factor, foamed polymer tape.” *Id.* at 5:25-27. The ’095 patent teaches that the separator “is not limited to the materials described,” and notes that other materials such as a polyolefin or glass fiber that is flame-retardant. *Id.* at 5:22-23, 5:40-43. The ’095 patent teaches that the separator may include a conductor, such as aluminum. *Id.* at 6:61-66. An example it provides is a pair separator is made of an aluminum/mylar tape. *Id.* at 6:33-35. The ’095 patent also claims a pair separator that includes a conductive layer. *Id.* at claims 24-26.

56. Various configurations of the pair separator are disclosed. For example, Figure 5 discloses a pair separator 14 with grooves that separate but do not completely enclose the channel, while Figure 6 discloses a pair separator 14 folded into a ‘plus’ shape:



Id. at 5:1-7, 6:12-19, Figs. 5 and 6 (annotated). Figure 8 discloses a similar shape to Figure 6, but the separator partially encloses one twisted pair:



Id. at Fig. 8 (annotated).

A. The Challenged Claims of the '095 Patent

57. The challenged claims include claims 27-33. These claims include two independent claims (27 and 31) and five dependent claims (dependent claims 28-30 depend from claim 27, and dependent claims 32-33 depend from claim 31).

B. Prosecution History

58. I have reviewed the prosecution history of the '095 patent. From my review, I understand none of the references that I discuss in this declaration were considered by the patent examiner during original patent prosecution, including

Roberts (EX-1009), GmbH-866 (EX-1010), Yanagida (EX-1012), Gingue (EX-1013), or Jachimowicz (EX-1014).

59. I understand that the examiner allowed the claims of the '095 patent during original prosecution because the examiner determined that “the prior art of record does not teach or suggest a cable comprising all the features as recited in the claims and in combination with a dielectric pair separator being substantially flat and being formed of a foamed polymer, and wherein the separator, the first twisted pair, and the second twisted pair are twisted about a common central axis to a twisted pair cable.” EX-1002 at 6.

60. It is my opinion that the references I discuss in this declaration teach the elements and combination that the examiner found to be missing.

C. Reexaminations before the USPTO

61. I have reviewed the reexaminations of the '095, '537, and '999 patents. *See generally* EX-1003, EX-1006, EX-1034.

62. I understand that none of the proceedings involved Roberts as a lead reference. Roberts was cited only as a secondary reference for a different issue in the '095 reexamination and the '537 reexamination.

63. I understand that the reexaminations involved GmbH-866 (EX-1010). I understand that examiners reached conflicting conclusions. For example, the '999 patent examiner found that GmbH-866 taught the “cabled about a common axis”

limitation, while the '095/'537 patents examiner found GmbH-866 was at most unclear. Based on my review of GmbH-866 and for the reasons I explain in more detail in this declaration, I agree with the conclusion of the '999 patent examiner.

64. I understand that the '095 patent reexamination did not involve Yanagida (EX-1012), though it was cited in an IDS (but never discussed). The '537 and '999 patent reexaminations did involve Yanagida. I understand that the examiners reached conflicting conclusions. The '999 examiner determined that Yanagida disclosed a “configurable” separator, while the '537 examiner found that Yanagida did not disclose a “configurable” separator. For the reasons I explain in the declaration, I agree with the '999 examiner's conclusion and disagree with the '537 examiner's conclusion.

65. I understand that each of the reexaminations also involved Gingue (EX-1013), and that prior to termination, each of the three reexaminations had found that where the distinction over the prior art was a “foamed polymer” claim element, Gingue made that obvious. The examiners did not think that the addition of foamed polymer made the claims patentable, due to the teachings of Gingue about the benefits of foamed polymer in communications cables. As I explain in more detail in this declaration, I agree with that conclusion.

66. I understand that the examiners in the reexaminations did not find the evidence submitted by the Patent Owner (Belden) about the success of its products,

as well related evidence, was persuasive. I understand this is referred to as secondary considerations evidence. I agree with the examiners that it does not appear that Belden showed that this evidence was tied to what was actually claimed by the '095 patent. EX-1003 at 54 ('095 patent), EX-1050 at 35-39 (Requestor's response in '095 patent reexamination); see also EX-1006 at 33 ('573 patent).

67. I understand the none of the reexaminations reached finality and that they were terminated in early 2012 at Belden's request due to a settlement.

D. District Court Litigation Involving the '095 Patent

68. I am generally aware that there was a U.S. District Court trial involving several Belden patents, including the '095 patent, the '537 patent, and the '999 patent. I understand that based on the evidence the jury saw, some claims were found valid and claim 31 of the '095 patent was found invalid. I also understand that the case was settled shortly after the conclusion of the trial.

VIII. Claim Constructions

69. I understand that in prior proceedings involving the '095 patent, there have been some disputes about the meanings of certain claim terms.

70. I understand that claim terms in a patent are to be given their plain and ordinary meaning, as would have been understood by a person having ordinary skill in the art, at the time of the alleged invention, which I am informed is

February 25, 1999, considering the language of the claims, the specification, and the prosecution history of record.

71. Below I provide my understanding of claim terms relevant to this declaration that were disputed in previous matters.

72. For all other terms, I have given the claim terms their plain and ordinary meaning, as would have been understood by a person having ordinary skill in the art as of February 25, 1999, in view of the claims themselves, the specification of the '095 patent, and its prosecution history.

A. Preamble – “data communications cable comprising” (independent claims 27, 31)

73. I understand that in general a preamble is not limiting if the body of the claim defines a structurally complete invention, and the preamble only states a purpose or intended use of the invention. I would understand “data communications cable” to only be stating an intended purpose.

B. “dielectric pair separator” (independent claims 27, 31)

74. I understand that for the purpose of this proceeding, a “dielectric pair separator” means a “separator that serves as a dielectric medium,” which is the definition provided by a federal court in a previous proceeding involving the '095 patent. EX-1052 at 2.

75. I understand that the term “dielectric pair separator” does not require that the separator *consists entirely* of dielectric. For example, claim 24 of the '095

patent recites a “dielectric pair separator,” and then further states that the “dielectric pair separator” must have both a “dielectric layer” and a “conductive layer”. EX-1001 at cl. 24; *see also* EX-1004 at cl. 14 (claiming a “flat configurable dielectric separator” that comprises a “conductive layer”). In addition, I do not see anything in the specification that would indicate to a POSITA that the pair separator must consist *solely* of dielectric material.

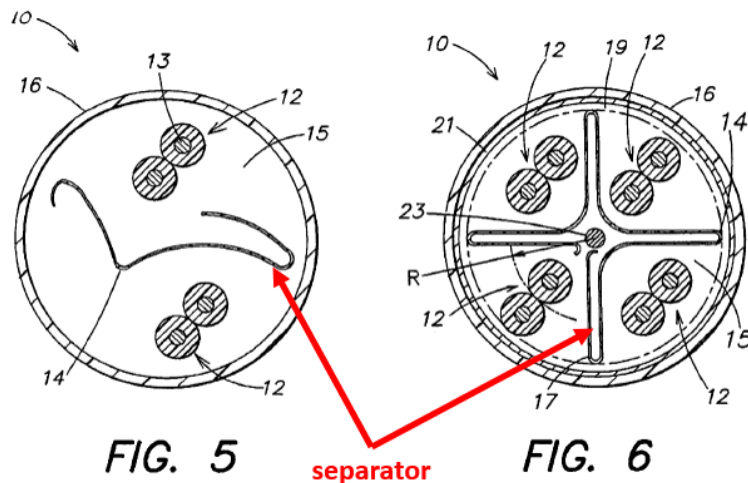
**C. “configurable dielectric pair separator being *substantially flat*”/
“configurable dielectric pair separator . . . including a *substantially flat* dielectric tape” (independent claims 27, 31)**

76. I understand that the meaning of a “substantially flat” separator, as would be understood by one of ordinary skill in the art in view of the ’095 patent’s claims, specification, and prosecution history, is a separator that is initially a substantially flat member prior to being formed into the cable. I also understand that the term does not require that the separator be substantially flat in the finished cable.

77. This construction is consistent with how a POSITA would understand the ’095 patent’s specification. For example, the pair separator 14 is described in the specification as “a flat configurable tape” and that in the preferred embodiment the pair separator “is supplied as a flat extruded tape.” EX-1001 at 6:12-25. The specification then explains that the pair separator 14 (a “flat configurable tape”) is

arranged in various shapes when in the final assembled cable to separate twisted pairs.

78. In Figure 5 the pair separator 14 “is configured such that the twisted pairs are disposed within channels or grooves 15 of the pair separator...” EX-1001 at 5:1-5. The patent also explains, with respect to Figure 6, that “the pair separator 14 is a flat configurable tape . . . that is shaped to have the illustrated profile...” EX-1001 at 6:12-14. I have reproduced and annotated these figures below:



EX-1001 at Figs. 5, 6 (Annotated). This is the only context in which the specification uses the word “flat” as applied to the pair separator 14 (whether prior to assembling or after assembling in the cable). The only other uses of the word “flat” in the specification are in reference to an alternative (non-circular) overall

shape of a cable, such as the cable having a “substantially flat configuration”

shown in Figure 10. EX-1001 at 8:24-26, Fig. 10.

79. I also note that claims of both the '537 and the related '095 patent would also indicate that the term “substantially flat” dielectric separator does not have to be substantially flat once in the final assembled cable. For example, claims 27 and 33 of the '095 patent each requires that the dielectric pair separator is both “substantially flat” and is “arranged within the jacket to form at least two grooves”. EX-1001. Claims of the '537 patent similarly require a “substantially flat configurable dielectric separator . . . in the finished communications cable” that is arranged into various shapes, e.g.: “arranged to have no more than one concave surface” (dependent claim 2), “arranged within the jacket to provide at least two grooves (dependent claim 3), “has a concave shape” (claim 17). I also understand that during prosecution of the related '537 patent, the patent applicant amended claim 1 to *add* a limitation (to distinguish the art) that the “substantially flat” separator must be “arranged . . . so as to be substantially flat in a radial cross-section taken through the finished communications cable.” EX-1044 at 3 (emphasis added).

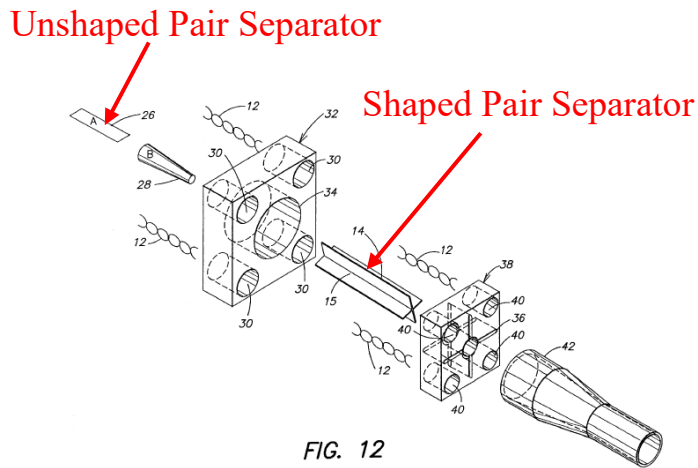
80. I understand that this construction is consistent with how previous patent examiners have construed the term in related patents that use the same term, for example with respect to the related '537 patent. EX-1006 at 10-11. That

examiner explained that Figures 4 and 5 of the specification show what the Patent Owner contends is an embodiment of the “substantially flat” separator, the only “reasonable interpretation of the term ‘substantially flat’...must be that the shape is flat when supplied, not in a finished product”. *Id.* This construction is also consistent with how a federal court construed the term in a previous litigation. In that previous litigation, the court construed the term “substantially flat” to mean “thin and substantially uniform in thickness.” EX-1052 at 3-4.

D. “Configurable” separator (claims 27-33)

81. I understand that the meaning of a “configurable” separator, as would be understood by one of ordinary skill in the art in view of the ’095 patent’s claims, specification, and prosecution history, is a separator that can be formed or arranged when the cable is being formed. “Configurable,” as used in the claims of the ’095 patent, does not require that the separator be reconfigurable or continue to remain “configurable” once in the finished cable assembly.

82. This is consistent with how a POSITA would understand the specification of the ’095 patent. The specification teaches that the separator is drawn from a reel, formed into a cylinder around a cob, aligned with the twisted pairs, and then “configured into a desired shape.” EX-1001 at 8:59-9:2; Fig. 12. This can be seen in Figure 12, which I have reproduced and annotated below.



EX-1001 at Fig. 12 (Annotated). The specification also discloses that the configurable pair separator “is configured such that the twisted pairs are disposed within channels or grooves...” EX-1001 at 5:2-5. The specification further describes the tape used to form the pair separator as “a flat configurable tape...that is shaped to have the illustrated profile...” EX-1001 at 6:12-15.

83. Similarly, the claims recite that the “configurable” separator is “arranged within the jacket to form at least two grooves.” *E.g.*, EX-1001 at claims 27, 33. The plain meaning of this phrasing to a POSITA, in view of the specification, is that the separator is “configurable” into that shape during the cable manufacturing/assembly process. A POSITA would not understand this to mean that one is able to “reconfigure” the separator into that shape *after* the cable has been manufactured and assembled.

84. I understand that this construction is also consistent with the construction provided by the federal court previous litigation involving the '095 patent, where the term was construed to mean “[f]lexible enough to be formed or shaped.” EX-1052 at 1-2. I also understand that this construction is consistent with how a patent examiner construed the same “configurable” separator term during an *inter partes* reexamination of the related '999 patent. I understand the examiner found that there was no basis to limit “configurable” to require that the separator remain “configurable” once *inside* the assembled cable, or that the separator must be “configurable” at “normal manufacturing temperatures,” and that even a heat formed separator would have been “configurable” at normal manufacturing temperatures. EX-1034 at 111-113.

85. I note that I am aware that the examiner during reexamination of the related '537 patent found that a plastic separator described as “rigid” in the Yanagida reference was not a “configurable” separator. EX-1006 at 27-28. However, as I explained above, I do not think that a POSITA would understand the '095 patent to be using “configurable” to mean that the separator has to remain configurable even after it is placed into the final cable assembly. And as I discuss below, the Yanagida patent certainly teaches that its core material 2 is configurable, as the core material is configured into a helical shape during the manufacturing process.

E. “Grooves” (claims 27-30, 33)

86. I understand that for the purpose of this proceeding, “grooves” means “Regions within a cable that are substantially physically separated from other regions with the cable by a pair separator; i.e., they are formed by, but need not be part of, the separator,” which is the definition provided by a federal court in a previous proceeding involving the ’095 patent. EX-1052 at 3.

IX. Overview of the Prior Art

A. Roberts (U.S. Pat. No. 3,622,683)

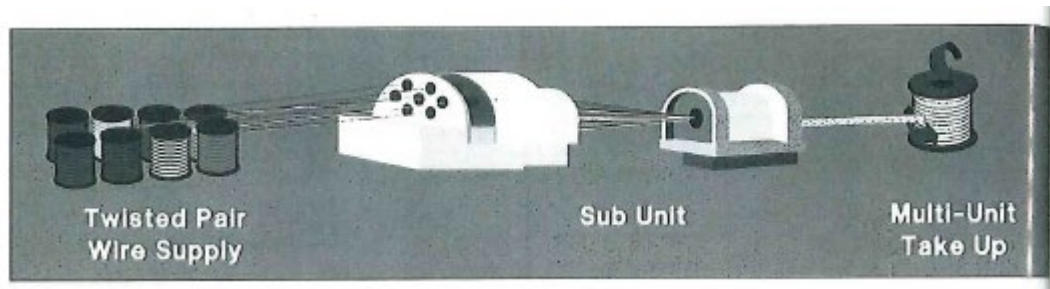
87. Roberts teaches a telephone cable, and a method of making it, that reduces crosstalk between electrical conductor pairs using a shield between the electrical conductor pairs. EX-1009 at Abstract; 13:34-36. Roberts teaches dividing a plurality of electrical conductor pairs into at least two portions by a “plastic-coated metal foil strip or tape.” EX-1009 at Abstract; *see also id.* at 3:28-52. By doing so, Roberts teaches that “crosstalk properties are [] vastly improved.” *Id.* at Abstract.

88. Roberts teaches an example of the dividing foil strip in the form of a “plastic-coated foil shield (15).” EX-1009 at 4:3-5, 10:52-62, Fig. 18. The dividing foil 15 is preferably coated on both sides with a plastic coating, so that the plastic coating acts “as a dielectric.” *Id.* at 3:37-52; *see also id.* at 13:40-46 (“dielectric protection can take the form of a firmly adhesive plastic coating . . .”).

89. Roberts teaches a dividing foil strip in various configurations to separate first and second groups of insulated electrical conductors (14) and (16). *E.g.*, EX-1009 at 4:2-16, 10:42-62. A POSITA would understand that such insulated electrical conductors are groups of twisted pairs. *E.g.*, *Id.* at Abstract (“**A plurality of insulated electrical conductors (*pairs*)**, of an otherwise conventional telephone cable design are divided into at least two portions by plastic-coated metal foil strip or tape . . . dividing electrical conductor telephone *pairs*...with plastic-coated metal foil”) (emphasis added); EX-1019 at 1:10-15 (“A typical telephone cable is constructed of twisted pairs of metal conductors . . .”); EX-1016 at 7 (“Most of the cables within the scope of AT&T’s EC&W product line utilize the twisted pair construction.”); EX-1017 at 11 (“The most commonly used transmission media in present-day digital loop applications is twisted pair metallic (copper) cable”); EX-1029 at 23 (“Twisted Pair Data Cables”), 25 (“Cables with twisted pairs are used where balanced signal transmission is required, together with low crosstalk”), 33 Fig. 55.1 (cross-section of telecommunication twisted pair cable); EX-1014 at 2:32-33 (“three pairs 10-14 [of insulated conductors] are each twisted with a different lay”).

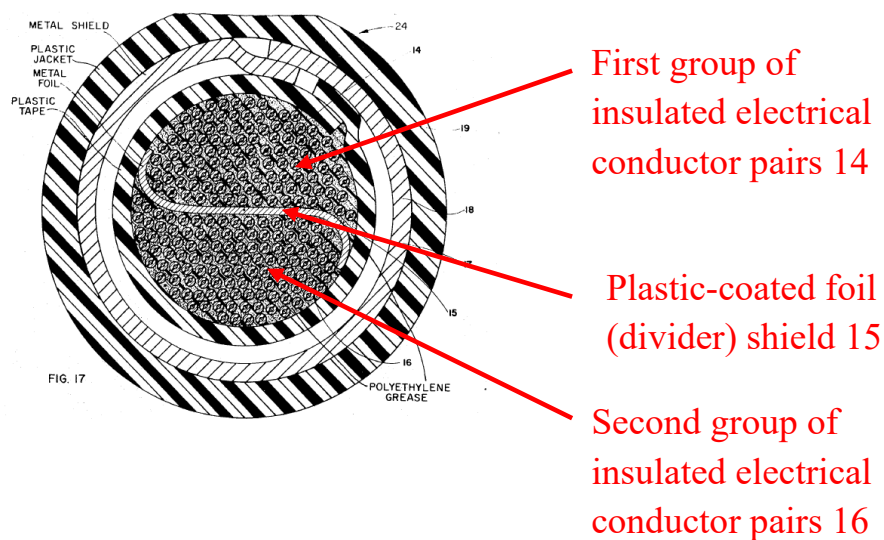
90. Twisted pairs were used in such cables at that time as they are today. In fact, it would have been uncommon for a cable of this type to have non-twisted pairs. *See* EX-1016 at 7. Typically, cables are manufactured by drawing twisted

pair though die plates into a laying tool that twists or “cables” the twisted pairs together. This is shown in cable manufacturing references. *E.g.*, EX-1016 at 9-10. I have reproduced a figure showing this process below:



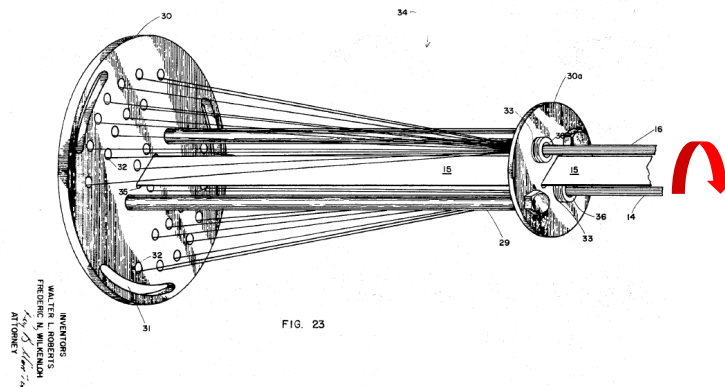
EX-1016 at 9. These die plates appear to be implementing a similar cabling process as implemented by Roberts. *Compare* EX-1009 (Roberts) at Fig. 23 *with* EX-1016 at 9.

91. In one embodiment disclosed by Roberts, foil strip shield or screen 15 may form an “S” (serpentine) shape separating groups of insulated electrical conductors. EX-1009 at 10:56-62, Fig. 17 (annotations added):



92. This configuration requires less divider shield material to manufacture, without the loss of any desired electrical properties such as mitigation of near-end crosstalk. EX-1009 at 11:7-12.

93. Roberts teaches that the embodiment of Figure 17 is created by forming a “*twisted composite* formed from elements (14), (15), and (16)”—the conductor pairs 14 and 16, the plastic-coated separator shield 15 twisted together about a common axis of the cable. EX-1009 at 12:14-29 (emphasis added). This is accomplished using a manufacturing tool such as shown in Figure 23, that Roberts explains is used to manufacture the embodiment of Figure 17:



Id. at 12:12-14 (annotation added).

94. To assemble the cable, insulated electrical conductors (twisted pairs) are pulled through holes 32 in dieplate 30 to holes 36 in dieplate 30a to form two sets of twisted insulated electrical conductors 14 and 16. EX-1009 at 11:75-12:8; Fig. 23. The shield or screen 15 is fed through center slot 35 in dieplates 30 and

30a. *Id.* at 12:2-4. The dieplates rotate while twisted pairs of conductors 14 and 16 and shield or screen 15 are fed through, producing the “twisted composite” of elements (14), (15), and (16). *Id.* at 12:14-29. Plastic tape, metal tape, and a plastic sheath are then added over the “twisted composite” to produce the cable shown in Figure 17. *Id.* at 12:30-39.

B. GmbH-866 (German Patent No. 297 19 866.1)

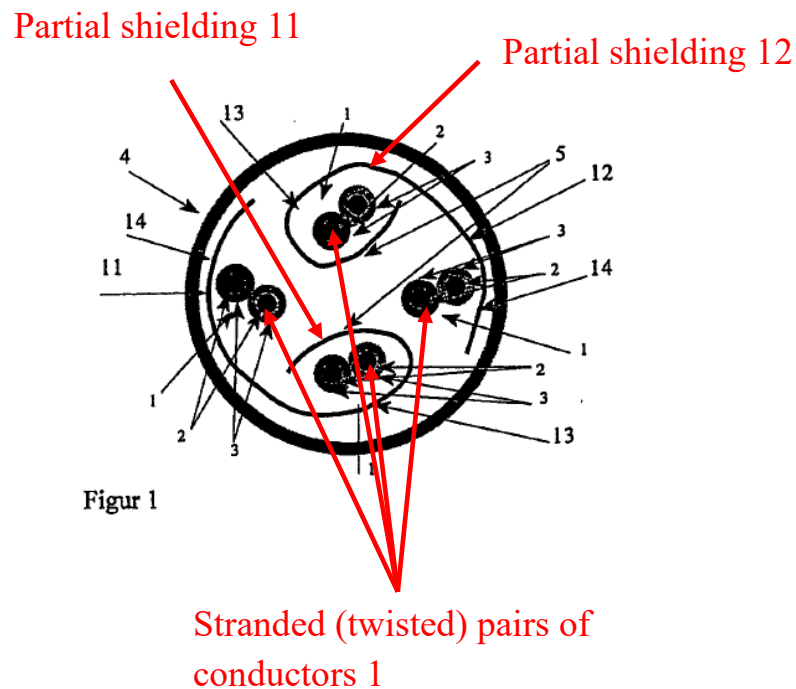
95. GmbH-866 teaches a “data transfer cable” with twisted, insulated conductor pairs that are “divided” from each other by a preferably plastic-coated metal foil shielding. EX-1010 at 3, 4. This allows the creation of cables with “optimized transfer properties,” including “a defined wave impedance and low coupling resistance, low damping, and low crosstalk”, at a lowered manufacturing cost. *Id.* at 2.

96. Each conductor pair is “stranded” together, forming a stranded pair. *E.g.*, EX-1010 at 3 (“Data transfer cables of this kind typically consist of four pairs of two stranded isolated copper conductors or wires”). “Stranding” is another word for helically twisting, to a POSITA. Each wire of these stranded pairs is preferably insulated with an insulation 3. *Id.*

97. The shieldings 5 preferably consists of metal foils that are “laminated by plastics material.” EX-1010 at 5. The plastic-coated shieldings 5 are positioned to “divide[] the cable cross section into at least two shielding sectors,” with a

(twisted) conductor pair “extend[ing] in each shielding sector,” so that the conductor pairs are “shielded from one another.” EX-1010 at 1, *see also* cl. 1.

98. For example, in figure 1, two “mutually independent partial shieldings 11, 12” are used to separate the four conducting twisted pairs 1:



EX-1010, pg. 2, 4 and Fig. 1 (annotated), *see also* cl. 1. This divides the cable cross-section into “four shielding sectors” such that “the conductor pairs [1] are shielded from one another.” *Id.* at 4.

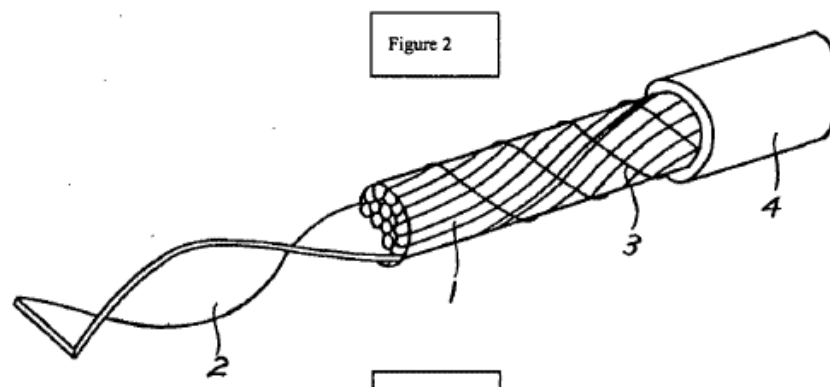
99. The stranded pairs of electrical conductors 1 and the shieldings 11, 12 are twisted or cabled together about a common axis. *E.g.*, EX-1010 at 5 (“The production of [the] data transfer cable . . . can take place such that the partial

shieldings 11, 12 . . . are applied together with the stranding [of] the conductor pairs 1 and/or the longitudinally extending deformation of the conductor pairs 1”). GmbH-866 teaches that especially if the twisted pairs are SZ-stranded, “the laying tools provided for the partial shieldings 11, 12 can assist the change in the stranding direction.” *Id.* at 6.

C. Yanagida (Japanese Patent No. Sho43(1968)-15470)

100. Yanagida relates to communications cables with alternately twisted cables. EX-1012 at 1[col.1]. The cables can include a plurality of “pairs” of stranded insulated wires 1. *Id.*; *see also* EX-1055, 1 (“stranded pairs”). Stranding is a common way to refer to twisting in the industry.

101. Yanagida teaches a cable formed with a “reciprocatingly twisted” core material 2 running through its center, and the wires 1 (e.g., the stranded (twisted) pairs) running along the surface of the twisted core material 2:



EX-1012 at 1[col.1], Fig. 2. The core element 2 is made from “hard plastic, or the like.” *Id.* The twisted core 2 that divides the groups of wires prevents the wires

from unravelling even when tensile force is applied in the longitudinal direction (a common problem for alternatingly stranded cables). *Id.* at 1[col.1]. A “cable sheath 4” covers the assembly to complete the cable. *Id.* at 1[col.1].

102. The twisted core 2 is initially a flat plate body. EX-1012 at 1[col.1]. During manufacture the core is thermally formed to create the reciprocatingly twisted form. *Id.* (“core material 2 is formed in a reciprocatingly twisted shape” by “twisting a flat plate-shaped hard plastic, or the like, while maintaining a given temperature”). Once the core is formed into the reciprocatingly twisted shape, the insulated element wires or stranded groups are run on the facing of both surfaces. *Id.*

D. Gingue (U.S. Patent No. 5,670,748)

103. Gingue discloses a composite insulation for electrical conductors in jacketed cables, including “data transmission cables,” that includes a layer of “foamed polymeric material.” EX-1013 at Abstract, 1:8-10, 5:18-22. Gingue teaches that the composite insulation having the foamed polymer has “reduced flame spread” while also having “favorable electrical properties.” EX-1013 at 1:9-12. I note that while the claims of Gingue are directed to materials for use to insulate a conductor, the “Background of the Invention” section discusses the favorable electrical properties and fire retardancy properties of foamed polymer used in cables generally. EX-1013 at 3:20-26 and col. 1-3 *generally*.

104. Gingue explains that it was known that electrical cables for voice and data transmission should be flame-resistant while exhibiting favorable electrical properties, which include materials with a “low dielectric constant.” EX-1013 at 2:1-13. Gingue further explains that foaming an insulating material was generally understood to both improve its electrical performance while also providing flame retardancy:

In general, the electrical performance of an insulating material is enhanced by foaming or expanding the corresponding solid material. Foaming also decreases the amount of flammable material employed for a given volume of material. Accordingly, *a foamed material is preferably employed to achieve a favorable balance of electrical properties and flame retardancy.*

Id. at 3:20-26 (emphasis added). Accordingly, Gingue discloses a two-layer insulation for data communications cables that includes an inner layer of a “foamed polymeric material.” *Id.* at 4:22-26. Gingue teaches that this foamed polymeric inner layer “optimizes the electrical characteristics (i.e., the dielectric constant and dissipation factor) of the material” *Id.* at 4:5-9. In the preferred embodiment, the foamed polymeric layer also includes an additive that renders the layer flame retardant and smoke suppressant. *Id.* at 4:37-39.

E. Jachimowicz (U.S. Patent No. 3,894,172)

105. Jachimowicz describes a data communications cable that has multiple sets of twisted pairs of conductors that are then “assembled in a twisted cable core”

and covered with a plastic jacket. EX-1014 at Abstract, 1:6-16. Jachimowicz describes a cable for sending “pulse code modulated signals,” which, as I explained above, a POSITA would understand to be a data communications cable.

106. Jachimowicz teaches an embodiment of three twisted pairs of conductors 10, 12, and 14, each twisted with a different lay. *Id.* at 2:28-34, Fig. 1.

107. A layer or “tape made of foamed thermoplastic supported by a film such as Mylar or polypropylene or other material” may be applied over the twisted pairs to hold them together and prevent lay distortion. *Id.* at 2:46-54. Jachimowicz teaches then providing a metal shield 24 over the “jacket or tape of foamed material 20,” explaining that the layer of foamed tape provides the further advantage of separating the twisted conductor pairs from the metal shield. *Id.* at 2:56-59. Jachimowicz explains that foamed material 20 may be “foamed polyethylene 20.” *Id.* at 2:48-50.

X. GROUNDS

A. GROUND 1: Roberts Anticipates Claims 27-29

1. Independent Claim 27

i. [27.pre] “A data communications cable comprising:”

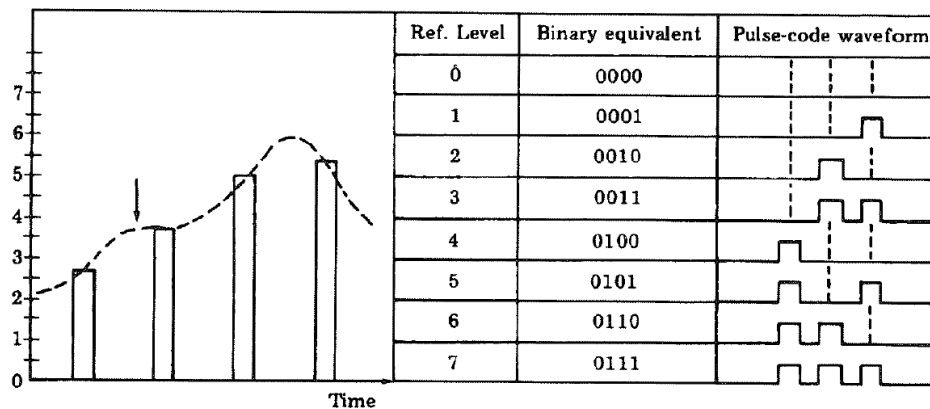
108. I understand that this claim element does not limit the claim.

109. Even if it did, Roberts discloses this claim element. Roberts shows a “multiconductor cable” used in communications systems such as telephone

networks. EX-1009 at 1:1-21; *see also id.* at Abstract (“telephone cable structure . . . possessing improved crosstalk properties”). Roberts discusses that its cable may be used in “pulse code modulator systems.” *Id.* at 13:10-29. A POSITA would understand that pulse code modulation (PCM)⁴ would be used to transmit digital data.

110. PCM is (and was at the time of Roberts) a method used to digitally represent sampled analog signals. Analog signals are sampled and assigned anearest reference level. Each reference level is assigned a binary code, also called

⁴ The IEEE dictionary explains PCM: “pulse code modulation (PCM) (1) (data transmission). The type of pulse modulation where the magnitude of the signal is sampled and each sample is approximated to a nearest reference level (this process is called quantizing). Then a code, which represents the reference level, is transmitted to the distant location. The figure above is an example of one form of PCM which has eight reference levels. It can be seen that a straight binary code would require a group of three pulses to be transmitted for each sample. The main advantage of PCM is the fact that at the receiving end only the presence or absence of a pulse must be detected.”



A form of pulse code modulation
Pulse Code Modulation (PCM) (1)

Ex. 1030 at 6-7.

a digital representation. The digital representation is then transmitted in the form of pulses. The modulated signal is then demodulated by the receiver. For at least this reason, Roberts discloses a data communications cable.

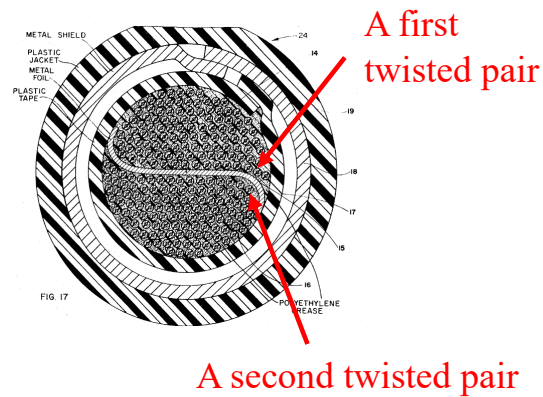
111. Roberts further discusses that its cable may be used for transmitting carrier frequencies. EX-1009 at 1:16-21. Transmission System 1 (T1) was developed in the early 1960s and first introduced in 1962. EX-1024 at 1:20-29. By the late 1970s, it was the dominant carrier system to connect cities between 10 and 50 miles apart. *See id.* at 1:22-25.

112. Roberts thus discloses this element.

ii. [27.a] “a first twisted pair of insulated conductors; a second twisted pair of insulated conductors;”

113. Roberts discloses this claim element, in the form of at least one of twisted pairs 14 and at least one of twisted pairs 16:

FIG. 17



EX-1009 at Fig. 17 (annotated), *see also id.* at Abstract, 12:6-8, 12:12-14.

114. Roberts explains that the cable has a plurality of “pairs” that are divided into two compartments by a shield as to prevent crosstalk. *See, e.g.*, EX-1009 at Abstract (“A plurality of insulated electrical conductors (*pairs*), of an otherwise conventional telephone cable design are divided into at least two portions by plastic-coated metal foil strip or tape . . . By dividing electrical conductor telephone *pairs* . . . with plastic-coated metal foil, the crosstalk properties are so vastly improved”). A POSITA would plainly understand that by referencing “pairs” Roberts was talking about twisted pairs.

115. For example, Roberts discusses reducing crosstalk between a disturbing “circuit” and a disturbed “circuit.” EX-1009 at 3:21-28. Roberts’ solution is to place a shield between the disturbing circuit and the disturbed circuit

that attenuates the wave energy produced by the disturbing circuit. *Id.* at 3:28-31.

A POSITA would understand that this is not referring to individual wires of twisted pairs. Other references, including Jachimowicz-340, use the “disturbing” and “disturbed” language and recognize that each circuit requires a pair. *See* EX-1022 at 1:7-10 (defining crosstalk as “the induction of current in the ‘*disturbed*’ *pair* by currents flowing in the ‘*disturbing*’ *pair*.” (emphasis added)).

Jachimowicz-340 is particularly informative as it discusses the solutions taught by Roberts including an S or Z shaped screen. *See* EX-1022 at 1:42-48.

116. Further, Roberts explains that the cable manufacturing process uses a die plate 30a shown at Figure 23 that has “holes (33) through which *twisted* electrical conductors (14) and (16) pass” and that the apparatus shown in Figure 23 is used to manufacture the cable shown in Figure 17:

FIG. 23 (manufacturing process)

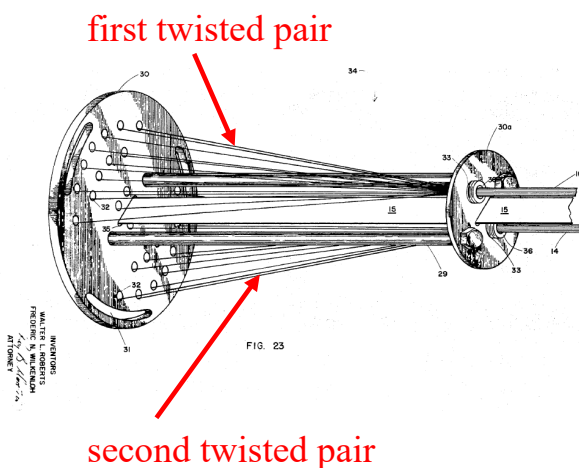
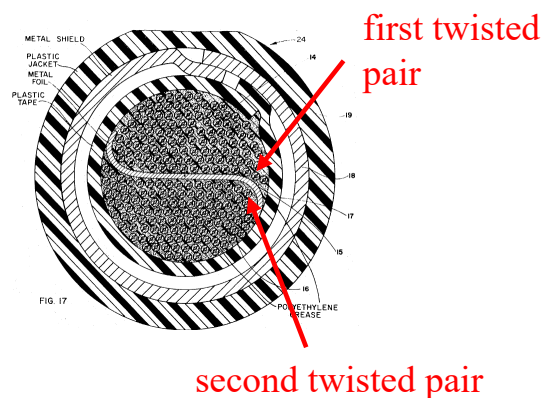
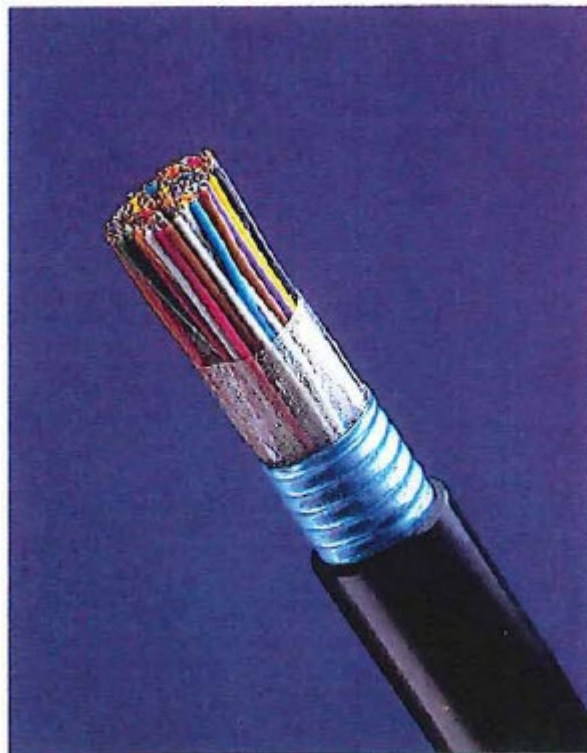


FIG. 17 (assembled cable)



EX-1009 at 12:6-8, 12:12-14, Figs. 23, 17. A POSITA would understand that each strand being pulled through the die plate holes 32 to hole 33 in die plate 30a, as depicted and described in Figure 23, is a twisted pair. EX-1009 at 12:5-12, Fig. 23; EX-1016 at 9 (“twisted pair wire supply” provides insulated twisted pairs that are then fed through a die plate into the stranding machine).

117. In addition, the Roberts FIGS. 1-4 illustrations of the conductors 14/16 is consistent with cables and twisted pair conductors as shown in prior art literature, such as the catalog page below (which lack the Roberts’ internal separator shield 15):



Cable Construction

CONDUCTORS: Solid bare annealed copper. Sizes 19, 22, 24 and 26 AWG (.9, .64, .5 and .4mm).

INSULATION: Individual copper conductors are insulated with a dual extruded cellular inner layer and a color coded solid outer layer of high density polyethylene or polypropylene.

TWISTED PAIRS: Insulated conductors twisted to form pairs with varying lays to minimize crosstalk and meet capacitance unbalance limitations.

EX-1035 at 20. This cable also shows an example of a “foamed polymer” insulation in a cable construction, which was well known by 1999.

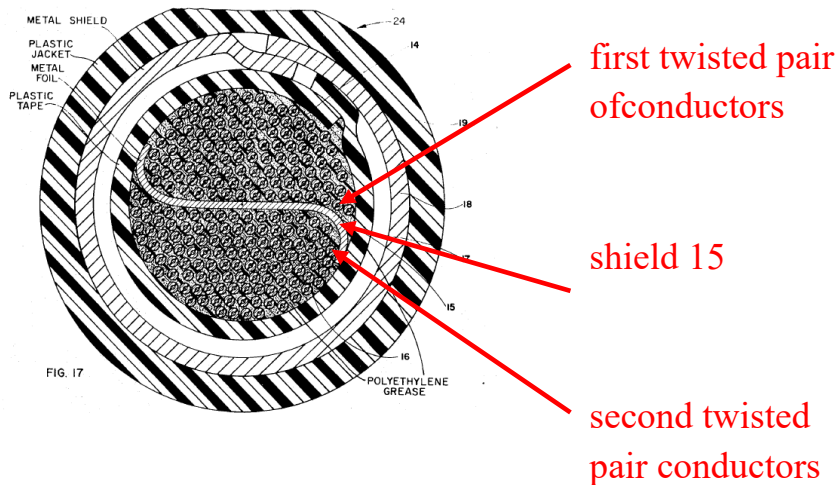
118. Unless it was specified expressly that a “pair” of copper conductors in a communications cable was *untwisted*, as of late 1998/early 1999 a POSITA would have understood that it was twisted. The use of twisted pairs in data communications cables was conventional and common practice both at the time of the Roberts patent (1968) and the '095 patent priority date (1999). *E.g.*, EX-1019 at 1:10-15 (“A typical telephone cable is constructed of twisted pairs of metal conductors . . .”); EX-1016 at 7 (“Most of the cables within the scope of AT&T’s EC&W product line utilize the twisted pair construction.”); EX-1029 at 23 (“Twisted Pair Data Cables”), 25 (“Cables with twisted pairs are used where balanced signal transmission is required, together with low crosstalk”), 33 Fig. 55.1 (cross-section of telecommunication twisted pair cable); EX-1017 at 11 (“The most commonly used transmission media in present-day digital loop applications is twisted pair metallic (copper) cable”); EX-1035 at 20 (“Insulated conductors

twisted to form pairs with varying lays to minimize crosstalk and meet capacitance unbalance limitations.”). EX-1013 at 2:32-33 (“three pairs 10-14 [of insulated conductors] are each twisted with a different lay”). This is because, as I explained above, twisting pairs of conductors was known to help prevent electrical noise and minimize cross talk. §VI.a, *supra*; EX-1016 at 7 (“The two main reasons for twisting pairs of conductors are to minimize or eliminate crosstalk and to decrease unbalanced mutual capacitance.”).

119. Roberts thus discloses this element.

- iii. **[27.b] “a configurable dielectric pair separator that separates the first and second twisted pairs of conductors, the configurable dielectric pair separator being substantially flat;”**

120. Roberts teaches a foil strip shield or screen 15 made of aluminum foil coated with a plastic (providing “dielectric protection”) that separates a first twisted pair of conductors from a second twisted pair of conductors:



EX-1009 at Fig. 17 (annotated). *See also* EX-1009 at Abstract (“A plurality of insulated electrical conductors (pairs) . . . are divided into at least two portions by plastic-coated metal foil strip or tape”; “dividing electrical conductor telephone pairs . . . with plastic-coated metal foil”), 10:48-62, 13:40-52, Fig. 17.

121. The shield 15 is a dielectric pair separator. The shield 15 component is taught as preferably coated on both sides with a plastic coating that is a dielectric: “there is in this instance a preference for the aluminum foil shield, coated on both sides with the polyethylene terephthalate (Mylar) dielectric.” EX-1009 at 3:32-52; *see also id.* at 10:59-60 (“metal foil coated on both sides with a

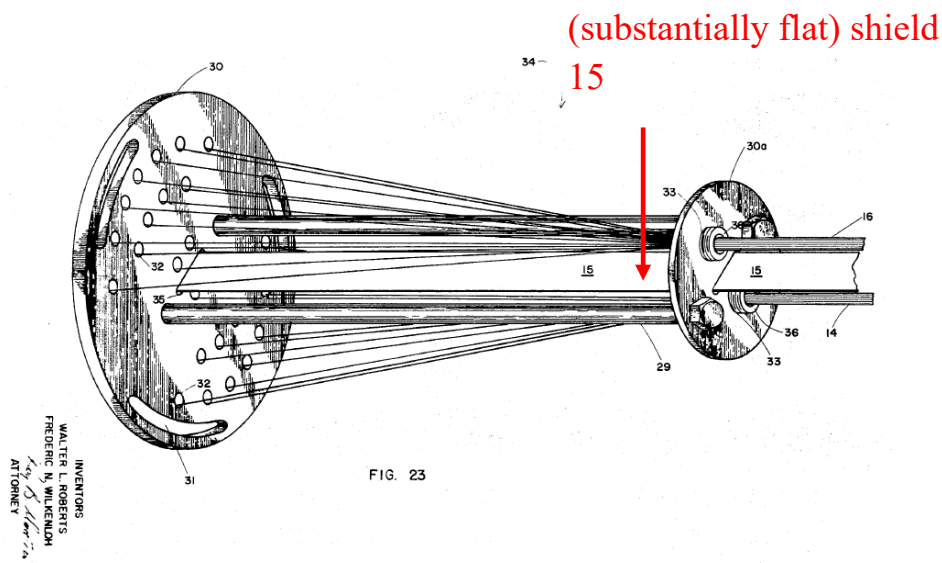
plastic”), 13:40-46 (“Dielectric protection can take the form of a firmly adhesive plastic coating . . .”), Figs. 5, 8, 18, 21. As explained above, a POSITA would not understand that a “dielectric pair separator” would be made *exclusively* of dielectric. Instead, a POSITA would understand that it has to serve as a dielectric medium. §VIII.B, *supra*. That what Roberts’ dielectric-coated shield 15 does, as it is taught as providing “dielectric protection.” EX-1009 at 13:40-46; *see also* EX-1031 at 4 (“Another term for an insulator or material that has poor electric conductivity. Dielectrics such as air, mica, paper, plastic film, or ceramic separate the metal foil or metallized plates in a capacitor to isolate them electrically . . .”).

122. The dielectric coating on Roberts’ shield 15 provides an additional insulator between the shield and the conductor pairs, which can help to prevent dielectric breakdown, which is also called a spark failure, during a high voltage test. The dielectric coating also helps to protect the aluminum foil during the manufacturing process. Uncoated aluminum foil can be easily damaged during the manufacturing process. The plastic dielectric coating protects the aluminum foil and prevents metal-on-metal contact during manufacturing.

123. The shield 15 is also configurable. The shield is made of a thin metal foil with plastic coating. *E.g.*, EX-1009 at 3:32-52, 10:52-62, 13:40-46, Figs. 5, 8, 18, 21. The Roberts patent shows that the shield 15 is configurable such that it can be formed into “an ‘S’ (serpentine) shaped shield or screen” and also twisted along

with the insulated electrical conductors to form a “twisted composite.” *Id.* at 10:56-58 and 12:14-30; Figs. 17, 23.

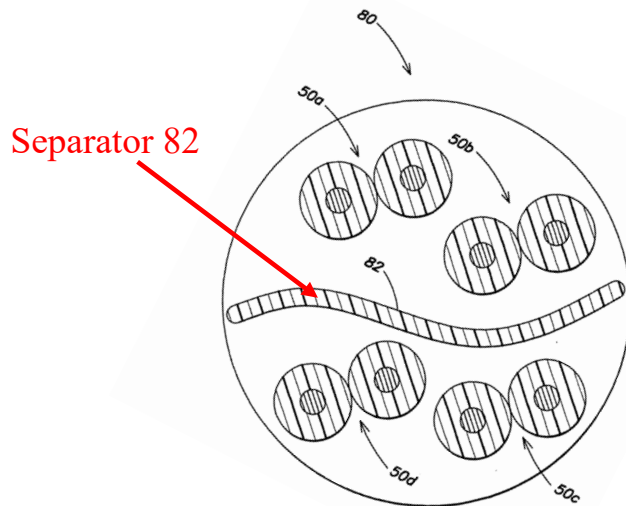
124. Finally, the shield 15 is substantially flat prior to being twisted into the final cable assembly. Roberts teaches that shield 15 is a flat “plastic-coated metal foil strip or tape.” EX-1009 at Abstract, 10:57-61. Figure 23, which shows a manufacturing process for the cable of Figure 17 (EX-1009 at 12:12-15), also shows that prior to twisting of the electrical conductor units and the shield 15 into a twisted composite, the shield 15 is flat:



Id. at Fig. 23.

125. In any event, a POSITA would also consider Roberts' shield 15 in Figure 17 to be substantially flat even in its assembled final form. *See* EX-1009 at Fig. 17. For example, I see that one of Belden's own published patent applications

calls a similar shaped separator “substantially flat.” EX-1025 at Fig. 3, ¶0044 (“the separator 82 may be substantially flat configurable tape, as shown in FIG. 3.”).

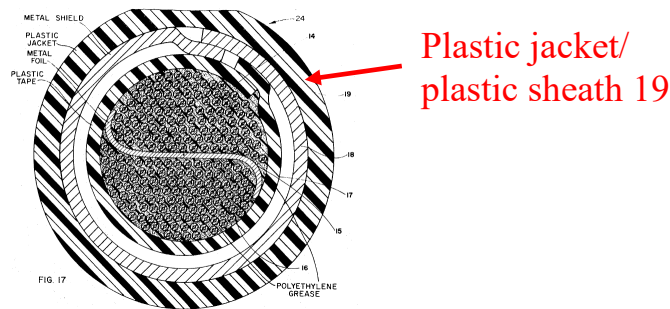


EX-1025 at Fig. 3 (Annotated).

126. Roberts thus discloses this element.

- iv. [27.c] “a jacket enclosing the first and second twisted pairs of insulated conductors and the dielectric pair separator; and”

127. Roberts teaches a “plastic jacket”/“plastic sheath 19” that encloses the first and second twisted pairs of insulated conductors and the shield 15. EX-1009 at 12:33-36; Figure 17 (annotated):



Thus, Roberts has a jacket that encloses the first and second twisted pairs (at least one of pairs 14 and at least one of pairs 16) and the dielectric pair separator (the shield 15).

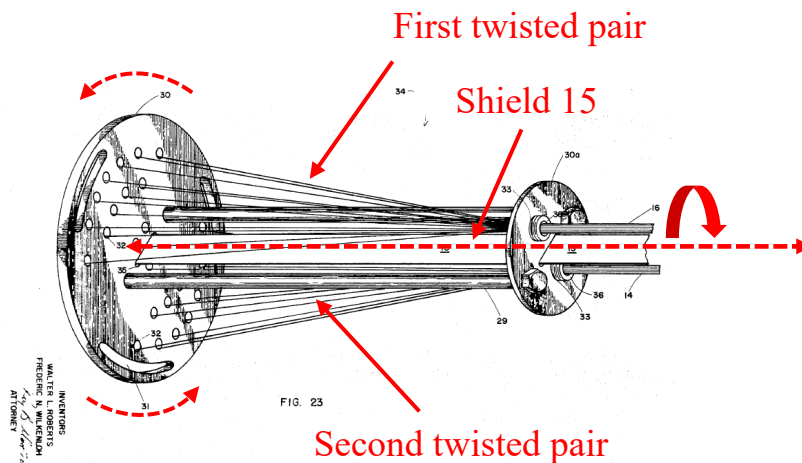
128. Roberts thus discloses this element.

- v. **[27.d] “wherein the configurable dielectric pair separator, the first twisted pair of insulated conductors and the second twisted pair of insulated conductors are twisted about a common central axis to form a twisted pair cable; and”**

129. Roberts explains that shield 15 and the insulated electrical conductors 14, 16 are twisted about a common central axis. The cable assembly shown in Figure 17 includes a “*twisted composite* formed from elements (14), (15), and (16).” EX-1009 at 12:14-29 (emphasis added). Elements 14 and 16 refer to the insulated electrical conductor groups that comprise a number of twisted pairs. Element 15 refers to the shield.

130. Roberts explains that the cable shown in Figure 17 is produced by drawing the insulated electrical conductor groups, including the individual twisted

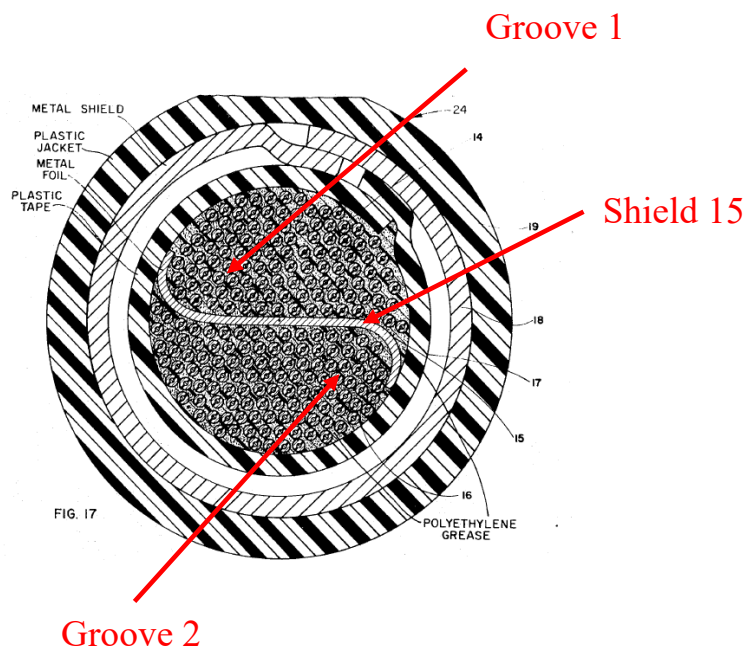
pairs, and the shielding through holes in dieplates 30 and 30a and applying a twist about an axis running between the centers of the dieplates (*a common central axis*):



EX-1009 at Fig. 23 (Annotated), 11:75-12:26. As shield 15 passes through slots 35 in the dieplates and the twisted pairs that make up the insulated electrical conductor groups pass from holes 32 in dieplate 30 to hole 33 in dieplate 30a, the dieplates are rotated by a rotating cage that is attached to dieplate 30 via slots 31. *Id.* at 11:73-12:26. The rotation causes “twisting and therefore composite forming” as the electrical conductors 14, 16 and shield 15 exit dieplate 30a. *Id.* at 12:22-26. Plastic tape, metal tape, and a plastic sheath or jacket are applied downstream about the “twisted composite” formed from the conductors 14, 16 and the shield 15. *Id.* at 12:26-38.

- vi. [27.e] “wherein the configurable dielectric pair separator is arranged within the jacket to form at least two grooves.”

131. Roberts shows that the shield 15 (the separator) is arranged within the plastic jacket to form at least two grooves. This is visible in Figure 17, that I annotated below:



Roberts at Fig. 17 (Annotated); *see also id.* 10:55-57; 12:22-26.

132. Roberts thus discloses this element. For the reasons given above, a POSITA would understand Roberts to disclose a cable with the elements recited in Claim 27 and anticipate this claim.

2. Claim 28: “The data communications cable as claimed in claim 27, wherein the configurable dielectric pair separator is arranged to provide a sufficient spacing between the first

twisted pair of insulated conductors and the second twisted pair of insulated conductors so as to provide a desired crosstalk isolation between the first twisted pair of insulated conductors and the second twisted pair of insulated conductors.”

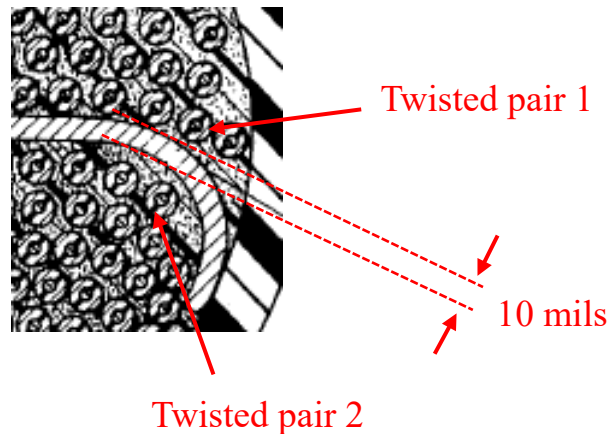
133. Roberts teaches this. Roberts teaches that the dielectric-plastic-coated shield 15 (the pair separator) is arranged to provide sufficient spacing between the first twisted pair of insulating conducts and the second twisted pair of insulated conductors so as to provide a desired crosstalk isolation between the first twisted pair of insulated conductors and the second twisted pair of insulated conductors. Roberts specifically references the improved crosstalk properties of its cable. *E.g.*, EX-1009 at Abstract (“cable structure possessing improved crosstalk properties”; “crosstalk properties are so vastly improved”), 13:30-45 (“improved nearend crosstalk properties are realized”).

134. A POSITA would have known that such “vastly improved” crosstalk properties meant providing an increased crosstalk *isolation*. Crosstalk was known in the communications cable industry to be a negative, performance-degrading phenomena, thus “improving” crosstalk properties was understood to mean improving crosstalk isolation (i.e., decreasing crosstalk).

135. Roberts’ shield or screen 15 is arranged to provide sufficient spacing by being situated such that it “divid[es]” a twisted pair in one group (14) from a twisted pair in the other group (16). EX-1009 at 10:50-52, 13:34-36 (“By

screening or shielding one transmitting group of insulated electrical conductors, improved nearend crosstalk properties are realized”).

136. Roberts also teaches that the plastic-coated shield or screen may be approximately 10 mils thick:



EX-1009 at Fig. 17 and 4:57-60 (“Foil (6) has a thickness between 1 and 5 mils and is generally twice the thickness of plastic coating (5a)”). Roberts teaches that coating may be applied to both sides of the foil. *E.g.*, EX-1009 at Figs. 5, 8, 18, 21, 2:29-31, 2:37-38, 3:3-4, 3:5-7. If the foil is 5 mils thick and twice the thickness of the plastic coating, then the plastic coating applied to the foil on each side is 2.5 mils thick. Thus, the total thickness would be 10 mils. One “mil” means one one-thousandth of an inch. Therefore, 10 mils is 10 one thousandths of an inch, or 0.254mm.

137. For the particular plastic-coated shield or screen 15 disclosed by Roberts, the separator screen is arranged to provide sufficient spacing between the

twisted pairs on each side of the shield or screen 15, such that crosstalk properties are “vastly improved.” EX-1009 at Abstract. Roberts also measures the crosstalk of cables practicing the invention and compares it with conventional cables “not employing a shield or screening tape.” *Id.* at 12:53-63. Roberts’ data shows that the near end crosstalk was significantly reduced by the shield or screening tape, especially at higher frequencies. *Id.* at 12:71-13:9; Fig. 24.

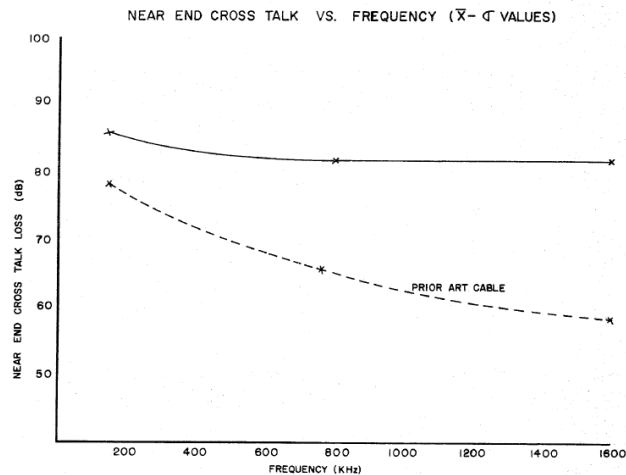


FIG. 24

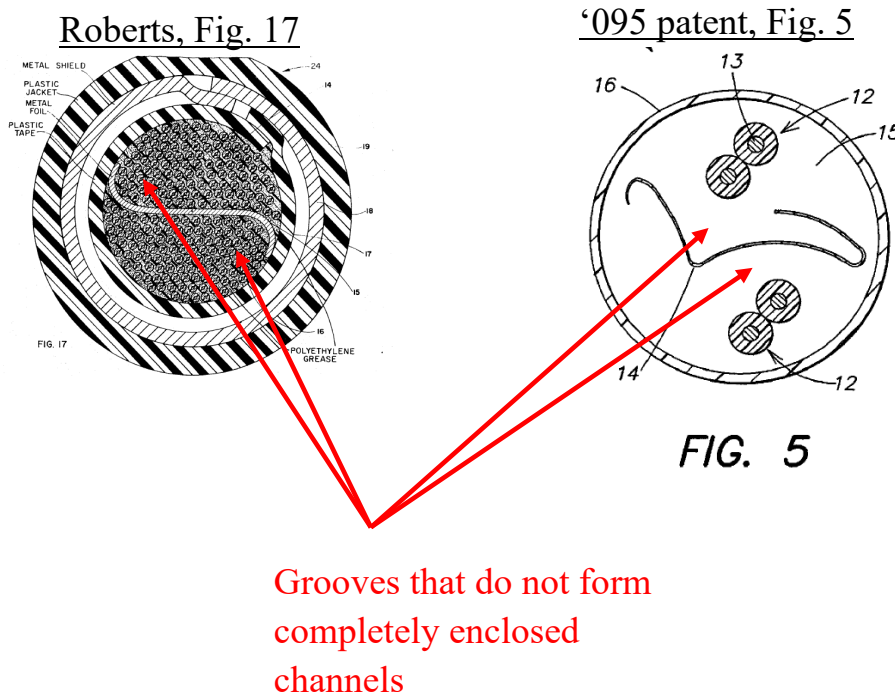
138. Roberts thus discloses this element. For the reasons given above, a POSITA would understand Roberts to disclose a cable with the elements recited in Claim 28 and anticipate this claim.

3. Claim 29: “The data communications cable as claimed in claim 27, wherein the at least two grooves do not form completely enclosed channels.”

139. Roberts teaches a dielectric shield 15 with at least two grooves that do not form completely enclosed channels. EX-1009 at 10:54-55 (“this particular

shield does not circumscribe any one group of insulating electrical conductors”).

This is shown in Figure 17:



Id. at Fig. 17 (Annotated); compare with EX-1001 at Fig. 5. The grooves in the shield 15 of Roberts are like the grooves depicted in the '095 patent at Figure 5, which the '095 patent describes as having grooves that do not form completely enclosed channels. EX-1001 at 5:6-7 (“As illustrated, the grooves 15 do not form completely enclosed channels”).

140. Roberts thus discloses this element. For the reasons given above, a POSITA would understand Roberts to disclose a cable with the elements recited in Claim 29 and anticipate this claim.

B. GROUND 2: A POSITA Would Have Been Motivated, with a Reasonable Expectation of Success, to Modify Roberts in view of Jachimowicz and/or Gingue (Claims 30-33)

1. Claim 30: “The data communications cable as claimed in claim 27, wherein the configurable dielectric pair separator comprises a foamed polymer tape.”

141. Roberts has all of the elements of independent claim 27, as I explained above. I note that Roberts does not have a construction “wherein the configurable dielectric pair separator comprises a foamed polymer tape,” as is stated by claim 30. This would have been an obvious modification to Roberts, particularly in view of the teachings of Jachimowicz and/or Gingue. Separating twisted pairs with a foamed polymer buffer was already known in the art. *E.g.*, EX-1015 at Fig. 6 and cl. 19 (a “buffer” of foamed PVC separating twisted pairs).

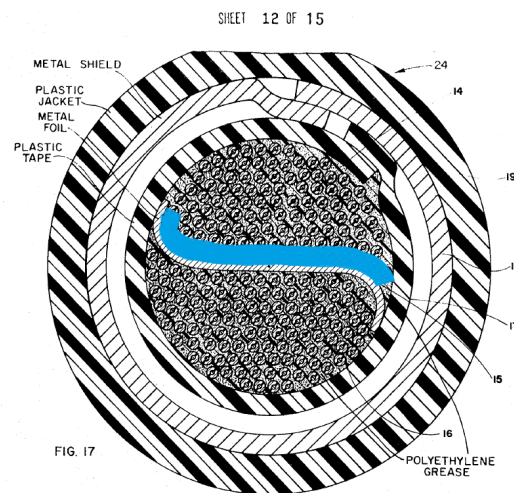
142. Jachimowicz teaches using a foamed polymer tape, and each of Jachimowicz and Gingue teach using foamed polymer as an insulating/isolating material in a communications cable. Jachimowicz teaches applying a layer or “*tape made of foamed thermoplastic*” supported by a film such as Mylar or polypropylene” over a set of multiple twisted pairs in a telephone communications cable. EX-1014 at 2:46-54 (emphasis added); *see also id.* 2:56-59 (explaining that the “jacket or tape of foamed material 20” advantageously separates the twisted conductor pairs from the metal shield). Gingue teaches insulation for electrical conductors in jacketed cables, including “data transmission cables,” that includes a

layer of “*foamed polymeric material*.” EX-1013 at Abstract (emphasis added), 1:8-10, 4:2-3 (“foamed or expanded polyolefin material”), 4:22-36 (“[t]he preferred foamed inner layer polymeric material comprises foamed polyethylene or foamed polypropylene”), 5:18-22.

143. In view of the teachings Jachimowicz and/or Gingue, it would be apparent to a POSITA that a foamed polymer tape for use as an insulating/isolating material in a communications cable would be dielectric, having a very low dielectric constant. Gingue explains that polymers such as “polyethylene and polypropylene . . . hav[e] favorable electrical properties as manifested by their very low dielectric constant” (EX-1013 at 2:10-14), that foaming the corresponding solid polymer (i.e. adding air pockets) provides “enhanced” electrical performance over the non-foamed polymer (EX-1013 at 3:20-26), and that the foamed inner layer provides “an insulation material having favorable dielectric properties” (EX-1013 at 6:36-37). Jachimowicz then discloses a foamed polymer tape and explains that the polymer can be “foamed polyethylene.” EX-1014 at 2:46-54. Polyethylene is one of the polymers that Gingue teaches has a “very low dielectric constant,” and then Gingue teaches that foaming the corresponding solid polymer will provide even better electrical properties. EX-1013 at 2:10-14, 3:20-26.

144. A POSITA would have been motivated, with a reasonable expectation of success, in view of the teachings of Jachimowicz and/or Gingue and the

knowledge of a POSITA, to modify the “plastic-coated metal foil strip or tape” taught by Roberts to include a substantially flat dielectric foamed polymer tape, either on one or both sides of the shield 15. This is true whether the POSITA would provide the foamed polymer tape instead of a non-foamed plastic coating on the shield 15 of Roberts, or in addition to a non-foamed plastic coating. I provide a conceptual example with foamed polymer on one side of the shield 15 below:



EX-1009 at Fig. 17 (dielectric foamed polymer tape depicted in blue).

145. There was market pressure in the communications cable industry to increase cable performance and reliability, which meant trying to improve transmission loss. It was also known that metal shielding around twisted pairs (such as that shown by Roberts) caused detrimental transmission loss. EX-1015 at 2:54-65 (“[A]s the electric and magnetic fields are confined [by shielding], capacitance . . . change[s] in such a way as to increase transmission loss.”).

Further, separating twisted pairs with a foamed polymer buffer also already known

in the art. *E.g.*, EX-1015 at Fig. 6 and cl. 19 (a “buffer” of foamed PVC separating twisted pairs). In my opinion, a POSITA would have been motivated to make this modification, to predictably improve the performance and reliability of Roberts’ cable, for at least two reasons.

146. **First**, modifying the Roberts foil strip/tape to include a foamed polymer tape would have been expected to provide improved electrical performance (as compared to a non-foamed polymer) by reducing the capacitance between the separator and the twisted pairs within a group. Current leakage arises when two conductors are separated by a dielectric material, forming a capacitor. If an alternating current is applied to the conductor, some current will flow through the capacitor resulting in some current loss. This is a common problem in any kind of transmission line. Reducing the capacitance between the conductors and the separator reduces the amount of current that is leaked (and therefore decreases the transmission losses of the cable). There were several known ways to reduce capacitance: (1) lowering the dielectric constant of the material between the conductors, (2) increasing the distance between the twisted pairs and the conductive components, and (3) reducing the area of the conductors.⁵

⁵ As an example, the capacitance of a parallel plate capacitor is: $C = \epsilon_0 \frac{A}{d}$ where C is the capacitance, ϵ_0 is the dielectric constant, A is the area of the parallel plates, and d is the distance between the plates.

147. A POSITA would have expected the addition of the low-dielectric constant foam tape material taught by Gingue and/or Jachimowicz to predictably reduce the capacitance, and thus reduce the current leaking out from the pairs during transmission that causes transmission loss, by doing the first two things—lowering the dielectric constant of the material between conductors and increasing the distance between the twisted pairs and the conductive components.

148. Lowering the dielectric constant: the foamed polymer tape would have predictably decreased the dielectric constant between twisted pairs and the separator shield 15. As I explained above, Jachimowicz and Gingue teach that the foamed polymer has a low dielectric constant. Foaming was known to enhance electrical performance by reducing the dielectric constant of the dielectric material. See EX-1013 at 3:20-26 (“the electrical performance of an insulating material is enhanced by foaming or expanding the corresponding solid material.”); *Id.* at 2:11-13 (explaining that enhanced electrical performance means “***low dielectric constant*** and low dissipation factor.” (emphasis added)). Foaming reduces the dielectric constant (thereby enhancing electrical performance) because it traps air, which has a very low dielectric constant, in the material. As I also explained above, Jachimowicz teaches a foamed polymer tape and explains that the polymer can be “foamed polyethylene” (EX-1014 at 2:46-54), which is one of the polymers Gingue teaches has a “very low dielectric constant.”

149. Increasing the distance between conductors: Adding foamed polymer tape to Roberts' shield 15 would also predictably increase the distance between the groups of twisted pair conductors and the shield 15, due to the added thickness of the foamed polymer tape. *E.g.*, EX-1015 at 2:60-65 (in order to compensate for "increased [transmission] losses" due to shielding of twisted pairs, "the conductor insulation must be increased in thickness"). This also would predictably further decrease the capacitance between twisted pairs and the separator, reducing the insulation dimensions for the insulation needed on the copper conductors of the twisted pairs to maintain the desired electrical properties of the cable.

150. **Second**, the foamed material would provide additional dielectric "protection" between the conductor pairs and the shield. Roberts teaches that the plastic coating on the metal foil strip/tape 15 provides "dielectric protection" from unwanted electrical energy that may escape from imperfections in the insulation surrounding the conductors of the twisted pairs, preventing that energy from reaching the metal shield. EX-1009 at 13:41-45, 3:39-51.

151. Dielectric protection was known to be particularly important in data communication cables as such cables must withstand a high voltage dielectric breakdown test, commonly referred to as a "spark test". This test involves applying a high voltage to the cable to determine if there are any weak points in the insulation (often resulting in a spark). Weak points may be caused by pinholes in

the insulated coating of the conductors or the shield or mechanical damage to the insulation caused by mechanical forces subjected to the pairs during assembly.

152. Adding a foamed polymer tape would have predictably enhanced this protection from unwanted electrical energy in two ways. *See* EX-1026 at 3:21-24 (“Foam heat-resistant plastic tapes...are desirable where high dielectric strength is needed between the sheath and the cable core”). First, it would create additional distance between the conductor pairs and the shield, further increasing the dielectric protection. The larger the gap between conductive elements, the less likely to result in a dielectric breakdown between the shielding and the conductors. Second, the more dielectric material present, the less likely that a pinhole or damage to the insulation will result in a dielectric breakdown when high voltage is applied to the conductors. Therefore, the inclusion of protective dielectric materials in the form of a foamed polymer tape would reduce the likelihood of dielectric breakdown.

153. A POSITA would have had a reasonable expectation of success in modifying Roberts’ plastic-coated metal foil strip or tape 15 to include a substantially flat foamed polymer tape, because doing so would have been straightforward and would not have required any skill beyond routine engineering. There was substantial overlap in the technology discussed by Roberts, Jachimowicz and Gingue (all teach constructions of communications cables having

copper wires) and therefore, in my opinion, a POSITA would have expected to be able to predictably combine the teachings using only routine skill in the field.

154. In fact, Jachimowicz teaches a foamed thermoplastic tape “supported by a film such as Mylar or polypropylene or other material.” EX-1014 at 2:46-54. Roberts *already* discloses coating its metal foil shield 15 with Mylar or polypropylene. EX-1009 at 3:35-37. Roberts also teaches that twisted pairs can be separated by a Mylar-only plastic tape 17a. Roberts, 7:43-46, Fig. 13. Thus POSITA would expect to easily provide a Mylar or polypropylene-backed foamed polymer attached to or next to Roberts’ foil shield 15. In addition, Roberts offers polyethylene terephthalate (Mylar), polyethylene, polypropylene, polystyrene, or PVC as examples of the plastic coating. EX-1009 at 3:54-57. These are the types of materials discussed and used in Gingue. *See* EX-1013 at 2:10; Table 1. Given this near-complete overlap in materials and technology, it would have been a simple, routine substitution for a POSITA to obtain a predictable result.

155. Roberts also teaches that the plastic-coating can be on one side of the metal foil, both sides of the metal foil, or completely surround the foil. EX-1009 at 10:55-61. A POSITA would have easily been able to substitute the plastic-coating described in Roberts for a foamed polymer tape such as that described by Jachimowicz, or simply add the foamed polymer tape to the top of the plastic coating, using known adhesives. To add the foamed polymer tape would not have

required any substantial modifications to the manufacturing process Roberts already teaches. *See* Roberts at 11:70-12:30 and Fig. 23. A POSITA would only have had to provide an additional foamed polymer tape, such as that taught by Jachimowicz, on the outside of (on one or both sides of) the Roberts' plastic-coated metal foil strip or tape 15 while laying up the cable. Alternatively, a POSITA would have expected to be able to just use a foamed-polymer-coated aluminum tape. Foamed-polymer-coated aluminum shielding was known in the art. *See* EX-1027 at 2:50-52 (teaching an "expanded, porous polytetrafluoroethylene containing a thin layer of aluminum"). The POSITA would then use the process described in Roberts to cable that foamed polymer tape-including shield into the final cable assembly.

156. In my opinion, a POSITA also would have expected to easily use the foamed insulator described in Gingue as the plastic coating (or in addition to the plastic coating) on the Roberts shield member 15 to obtain a predictable result and improved the cable in the same way as in Gingue: improved electrical performance due to the low(er) dielectric constant provided by the foaming of the insulation material.

157. Thus, it is my opinion that it would have been obvious to modify Roberts, based on the teachings of Jachimowicz and Gingue, to have the configurable dielectric pair separator comprise a foamed polymer tape.

158. Thus, Roberts in view of the teachings of Jachimowicz and Gingue renders this claim obvious.

2. Independent Claim 31

i. [31.pre] “A data communications cable comprising:”

159. Roberts teaches this, for the reasons I explained above. *Supra*, §X.A.1.i.

ii. [31.a] “a plurality of twisted pairs of insulated conductors;”

160. Roberts teaches this, for the reasons I explained above. *Supra*, §X.A.1.ii.

iii. [31.b] “a configurable dielectric pair separator disposed between at least two of the plurality of twisted pairs of insulated conductors”

161. Roberts teaches this, for the reasons I explained above. *Supra*, §X.A.1.iii.

iv. [31.c] “the configurable dielectric pair separator including a substantially flat dielectric tape formed of a foamed polymer;”

162. Roberts in combination with one or more of Jachimowicz and Gingue teaches that the configurable dielectric pair separator includes a substantially flat

dielectric tape formed of a foamed polymer, for the reasons I explained above.

Supra, X.B.1. For the reasons I explained with respect to claim 30, a POSITA would have been motivated, with a reasonable expectation of success, to make this modification to Roberts.

163. Thus, it is my opinion that it would have been obvious to modify Roberts, based on the teachings of Jachimowicz and Gingue, to have the configurable dielectric pair separator including a substantially flat dielectric tape formed of a foamed polymer.

- v. **[31.d] “a jacket enclosing the plurality of twisted pairs of insulated conductors and the configurable dielectric pair separator; and”**

164. Roberts teaches this, for the reasons I explained above. *Supra*, §X.A.1.iv.

- vi. **[31.e] “wherein the plurality of twisted pairs of insulated conductors and the configurable dielectric pair separator are twisted about a common axis to form a twisted pair cable.”**

165. Roberts teaches this, for the reasons I explained above. *Supra*, §X.A.1.v.

166. Thus, Roberts in view of the teachings of Jachimowicz and Gingue renders this claim obvious.

3. Claim 32: “The data communications cable as claimed in claim 31, wherein the configurable dielectric pair separator is arranged to provide a sufficient spacing between the at least two twisted pairs of insulated conductors so as to provide a desired crosstalk isolation between the at least two twisted pairs of insulated conductors.”

167. Roberts teaches this, for the reasons I explained above with respect to claim 28. *Supra*, §X.A.2. I also note that modifying Roberts to include a foamed polymer tape would provide and maintain an even greater spacing between a twisted pair on one side of the separator and a twisted pair on the other side. And as I explained above, maintaining a larger distance between twisted pairs reduces cross-talk between them. EX-1023 at 3:17-24 (“The spacing of the pairs minimizes cross-talk between the pairs . . .”); EX-1015 at 7:58-61 (“The portions of the buffer system maintain the conductor pairs spaced apart which improves crosstalk performance”). Therefore, this obvious modification would result in an arrangement that provides an even larger amount of desirable cross talk isolation.

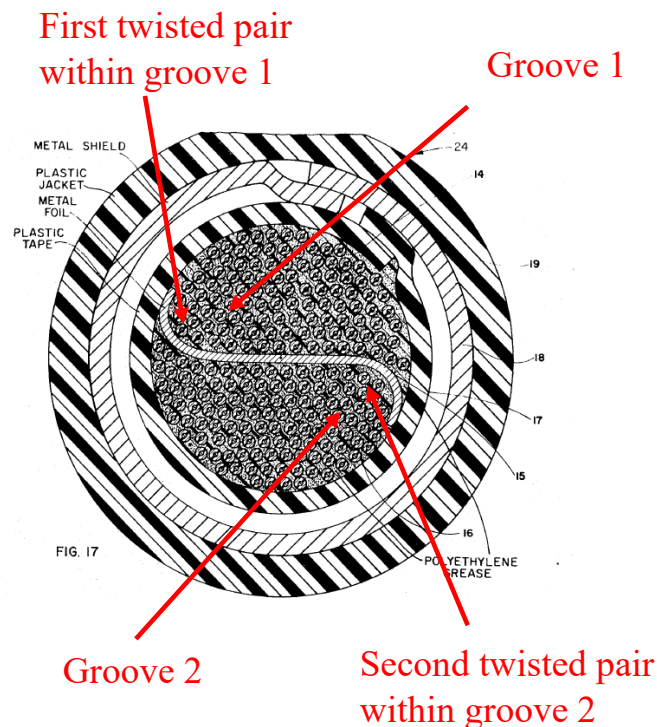
168. Roberts thus discloses this element.

169. With all of the other elements recited in Claim 31 already being disclosed by Roberts (*see* §X.B.a), it is my opinion that Claim 32 would be obvious to a POSITA at the time of the invention in view of Roberts modified by the foamed polymer tape of Jachimowicz and Gingue.

4. Claim 33: “The data communications cable as claimed in claim 31, wherein the configurable dielectric pair separator is

arranged within the jacket to provide at least two grooves, at least one twisted pair of conductors being disposed within each of the at least two grooves.”

170. Roberts teaches this for the reasons I explained above. *Supra*, §X.A.1.vi. Roberts also shows that at least one twisted pair of conductors is disposed within each of the at least two grooves:



EX-1009 at Fig. 17 (annotated).

C. GROUND 3: GmbH-866 Anticipates Claims 27-29

1. Independent Claim 27

- i. [27.pre] “A data communications cable comprising:”

171. I understand the preamble is not limiting.

172. Even if it did limit the claim, this element is taught by GmbH-866.

GmbH-866 discloses a “data transfer cable.” EX-1010 at 2; *see also id.* (describing cables with a transfer ranges (operational frequency range) “from 1 to 100 MHz or 1 to 600 MHz”). GmbH-866 explains that “[t]hese cables are used primarily in communications networks which demand optimized transfer properties, in particular, a defined wave impedance and low coupling resistance, low damping, and low crosstalk.” *Id.*

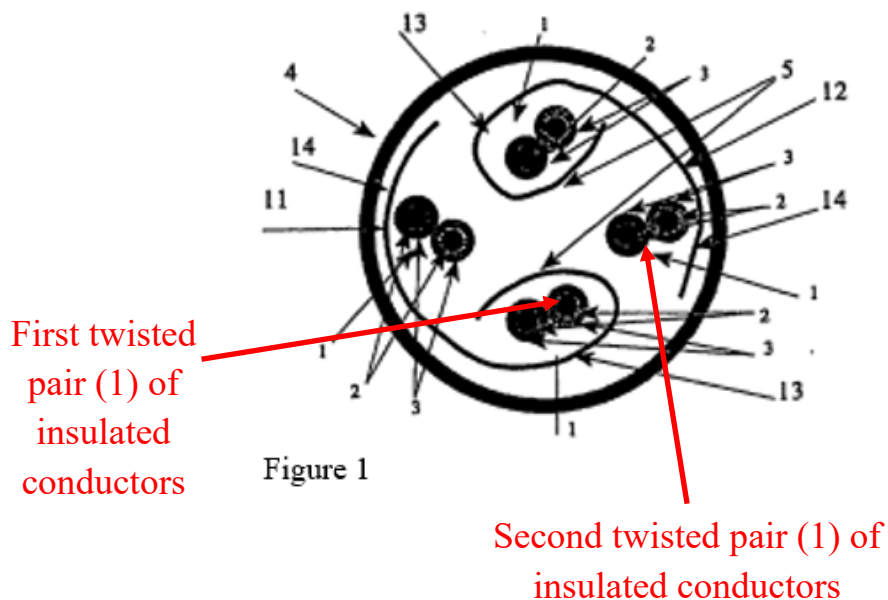
173. GmbH-866 thus discloses this element.

ii. [27.a] “a first twisted pair of insulated conductors; a second twisted pair of insulated conductors;”

174. It shows embodiments having plural twisted pairs of insulated conductors. GmbH-866 discloses in the last paragraph of page 2 that its cables each consist of an even number of isolated twisted conductor pairs: “A data transfer cable . . . shown in Fig. 1, comprises four pairs 1, each consisting of *two* isolated, *stranded copper conductors 2 or wires.*” EX-1010 at 3 (emphasis added); *see also id.* at 4 (“invention can also comprise just two pairs of *stranded conductors*” (emphasis added)). A POSITA would have understood that “stranded” in this context means “twisted.” “Stranding” was a term used in the cabling industry to connote twisting components together.

175. GmbH-866 discloses that the pairs consist of pairs of insulated conductors. Each pair consists of “two *isolated*, stranded copper conductors 2 or wires . . . [the] wires preferably have an *insulation* 3 . . .” EX-1010 at 3 (emphasis added).

176. The Figure 1 embodiment disclosed by GmbH-866 shows four twisted pairs of insulated conductors:



Id. at Fig. 1 (Annotated).

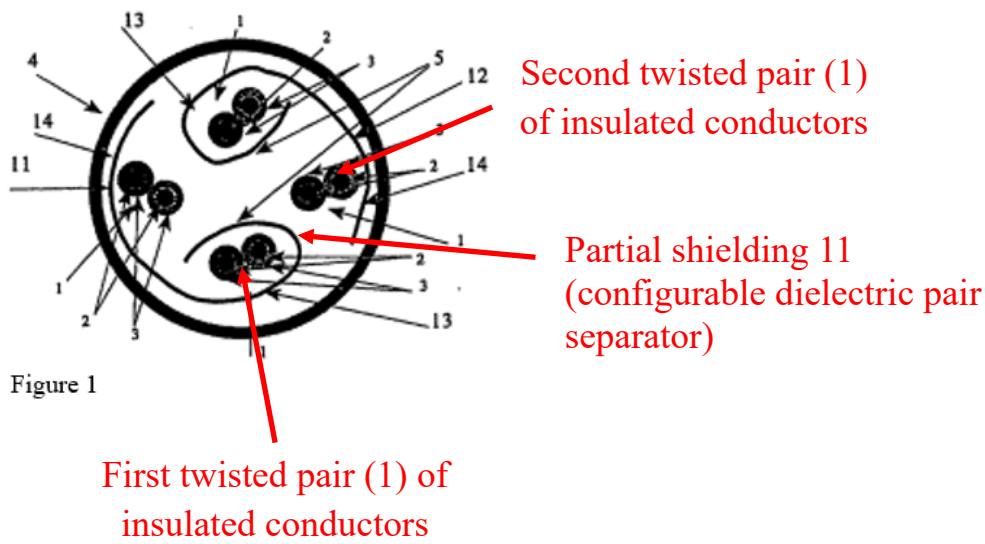
177. Further, it was conventional practice to use twisted (stranded) pairs of insulated copper wires in data communications cables as of February 1999 and for decades prior. EX-1014 at 2:28-34; EX-1019 at 1:10-15 (“A typical telephone cable is constructed of twisted pairs of metal conductors for signal transmission.”); EX-1016 at 7 (“Most of the cables within the scope of AT&T’s EC&W product

line utilize the twisted pair construction.”). GmbH-866 also discusses “wave impedance”. EX-1010 at 2. Impedance is highly dependent on spacing between conductors. Twisting conductor pairs provides consistent spacing between the two conductors. Thus a POSITA would understand that in discussing wave impedance, twisted pairs would be a known way of attaining consistent wave impedance.

178. GmbH-866 thus discloses this element.

- iii. **[27.b] “a configurable dielectric pair separator that separates the first and second twisted pairs of conductors, the configurable dielectric pair separator being substantially flat;”**

179. GmbH-866 discloses a cable with partial shieldings 11, 12 (each is a configurable dielectric pair separator) that each separates the first and second twisted pairs and is also substantially flat. This is shown in the figure I have annotated below:



180. GmbH-866 teaches that the shieldings 5 are preferably “metal foils, in particular, aluminum foils or aluminum foils laminated with plastics material.”

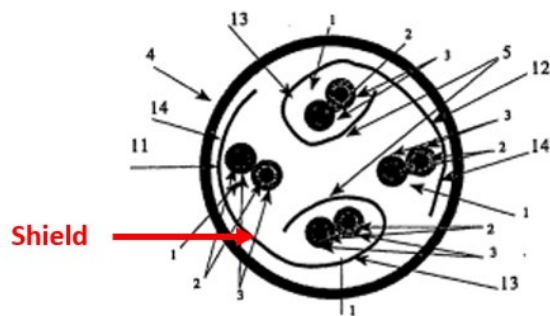
EX-1010 at 5. A POSITA would recognize that such a plastic material used to laminate aluminum foil is a dielectric. *E.g.*, EX-1031 at 4 (“Another term for an insulator or material that has poor electric conductivity. Dielectrics such as air, mica, paper, plastic film, or ceramic separate the metal foil or metallized plates in a capacitor to isolate them electrically . . .”).

181. As explained above, a POSTIA would understand that a “dielectric pair separator” need not consist *exclusively* of dielectric. *Supra*, §VIII.B. Rather, it serves as a dielectric medium. *Id.* A POSITA would recognize that the plastic-laminated aluminum foil shield taught by GmbH-866 does exactly that. It was known that plastic-coated foil, when used as a separator in communications cable

constructions, provided “dielectric” protection due to the plastic coating being a “dielectric material.” EX-1009 at 13:40-45 (explaining that the metal shield separator 15 is “protective by a dielectric material” and that such “[d]ielectric protection can take the form of a firmly adhesive plastic coating”). The plastic dielectric coating provides an additional insulator between the shielding and the conductor pairs. This helps, for example, to prevent dielectric breakdown during a high voltage test. The plastic dielectric coating also helps to protect the aluminum foil during the manufacturing process. Uncoated aluminum foil can be easily damaged during the manufacturing process. The plastic dielectric coating protects the aluminum foil and prevents metal-on-metal contact during manufacturing.

182. The partial shieldings 11 or 12 of GmbH-866 are configurable. For example, each is sufficiently configurable to form the shape of the number “6”.

EX-1010 at 4; Fig. 1 (Annotated):



Generally, aluminum foils laminated in plastic (the tape material disclosed for each partial shielding 11, 12) are sufficiently flexible to be wrapped partially around a twisted conductor pair.

183. The partial shieldings 11, 12 are substantially flat prior to application to the twisted pairs. As explained above, this is what I understand “substantially flat” requires. *Supra*, §VIII.C. The shielding taught by GmbH-866 is made out of aluminum foil laminated with plastic material with the thickness of the aluminum being between 20 and 60 μm . EX-1010 at 5. A POSITA would recognize that such a material is substantially flat prior to application. Foils of that thickness are generally flat as provided to the cable maker and commonly used as shielding in cables. It would be standard practice for the flat plastic-laminated aluminum foil to be fed into the cable and shaped during the laying and cabling process. GmbH-866 specifically references that this can be done with standard laying tools. *Id.* at 5-6.

184. I also note that Figure 5 of the '095 patent shows a separator that is similar in shape to the separator (partial shielding 11 or 12) of GmbH-866, Figure 5:

'095 Patent

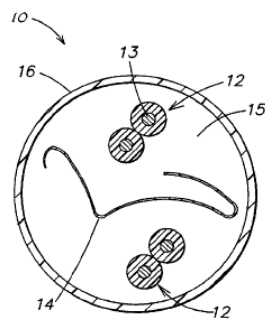
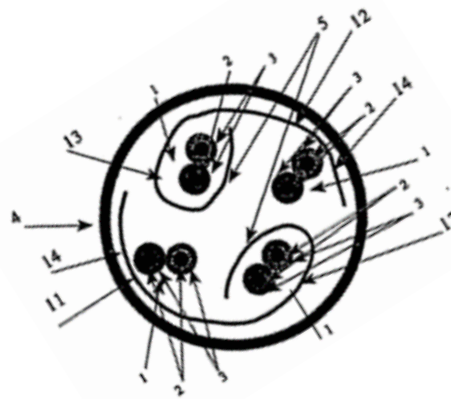


FIG. 5

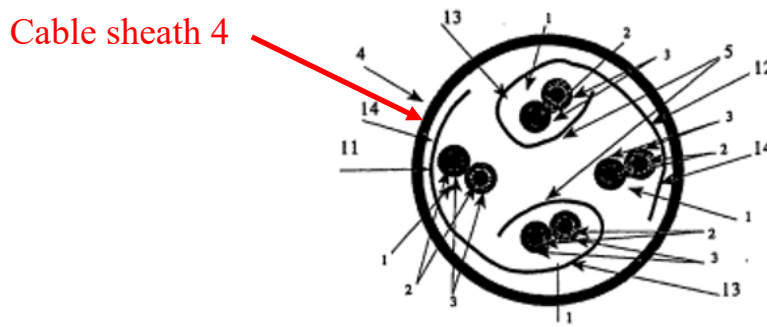
GmbH-866



185. GmbH-866 thus discloses this element.

- iv. [27.c] “a jacket enclosing the first and second twisted pairs of insulated conductors and the dielectric pair separator; and”

186. GmbH-866 has a cable sheath 4 (*jacket*) that encloses the insulated conductor twisted pairs 1 and partial shieldings 11, 12. GmbH-866 discloses a cable sheath made from thermoplastics that mechanically protects the cable. GmbH-866 at 4 (“transfer cable according to the invention comprises, as outer mechanical protection, a cable sheath 4 which consists of conventional thermoplastic sheath materials”). Figure 1 shows that cable sheath 4 encloses the first and second twisted pairs and the partial shieldings 11, 12 (each a dielectric pair separator):



EX-1010 at Fig. 1 (Annotated).

187. GmbH-866 thus discloses this element.

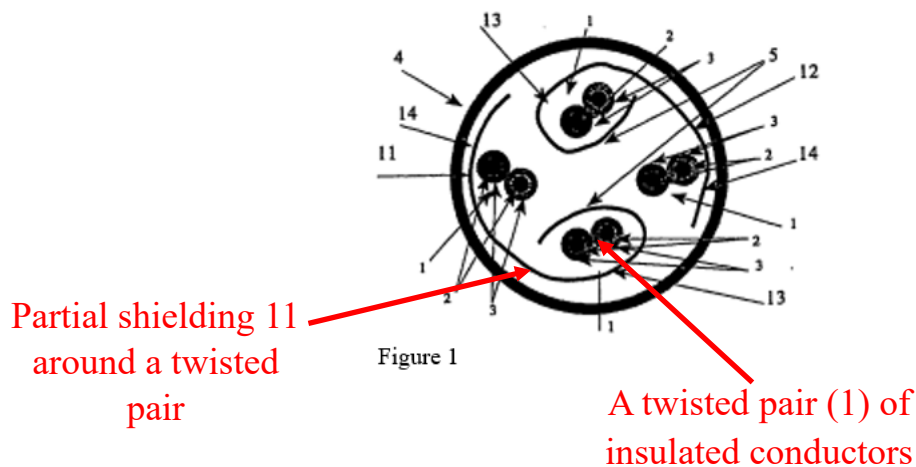
- v. **[27.d] “wherein the configurable dielectric pair separator, the first twisted pair of insulated conductors and the second twisted pair of insulated conductors are twisted about a common central axis to form a twisted pair cable; and”**

188. GmbH-866 teaches to a POSITA that the twisted pairs and shielding are twisted about a common axis. GmbH-866 discloses that the “stranding of the pairs 1 can consist in what is known as a helix stranding or an SZ stranding.” EX-1010 at 3. Helix stranding is in a single direction about a common axis. Similarly, SZ stranding also involves stranding about a common axis but with alternating twist directions. Both helix and SZ stranding result in twisting about a central axis to form a twisted pair cable.

189. The twisting, whether the result of helix or SZ stranding, includes the partial shieldings 11, 12. GmbH-866 discusses that the partial shieldings can be

applied with the stranding of the pairs. EX-1010 at 5 (“The production of the data transfer cable according to the invention...can take place such that the partial shieldings 11, 12 or 17, 18 are applied together with the stranding [of] the conductor pairs 1 and/or the longitudinally extending deformation of the conductor pairs.”); 1-2 (“The arrangement of the shielding according to the invention furthermore makes it possible for the *application or introduction of the shielding into the cable to take place by means of stranding...*”). In particular, GmbH-866 teaches that the laying tool used for SZ stranding provides for the shieldings. *Id.* at 5-6 (“In particular, in the case of the stranding of the conductor pairs in the SZ stranding method, the laying tools provided for the partial shieldings 11, 12 can assist the change in the stranding direction in each case.”).

190. A POSITA would understand GmbH-866 to disclose twisting multiple stranded pairs along with the partial shieldings 11, 12 about a common axis to create a cable assembly, not only twisting the individual wires into stranded pairs. First, applying the partial shielding with the stranding of the individual wires into pairs would be inconsistent with the GmbH-866’s teachings. GmbH-866’s Figures show the partial shieldings 11, 12 around the twisted pairs, not between the individual wires of each twisted pair. EX-1010 at Fig. 1-5. For example, Figure 1 is reproduced below:



Id. at Fig. 1 (Annotated). If GmbH-866 was referring to twisting of individual pairs into stranded pairs when it referred to the partial shieldings “applied together with the stranding of the conductor pairs 1,” the shieldings would end up between the individual wires. That is not shown in any figure of GmbH-866. *See Id.* at Figs. 1-5. It also does not make sense—there would be no reason to do that.

191. Second, a POSITA would understand that the GmbH-866 explanation that partial shieldings 11, 12 are “applied together” with the stranding and “can assist” in changing the direction of the stranding to indicate that the entire cable assembly, including the shieldings and the twisted pairs, are being stranded about a common axis to form the final cable assembly: “The production of a data transfer cable according to the invention, as described above, can take place such that the *partial shieldings 11, 12 or 17, 18 are applied together with the stranding* [of] the conductor pairs 1 and/or the longitudinally extending deformation of the conductor pairs 1. In particular, in the case of the stranding of the conductor pairs in the . . .

SZ stranding method, the laying tools provided for the partial shieldings 11, 12 **can assist** the change in the stranding direction in each case.” EX-1010 at 5-6 (emphasis added).

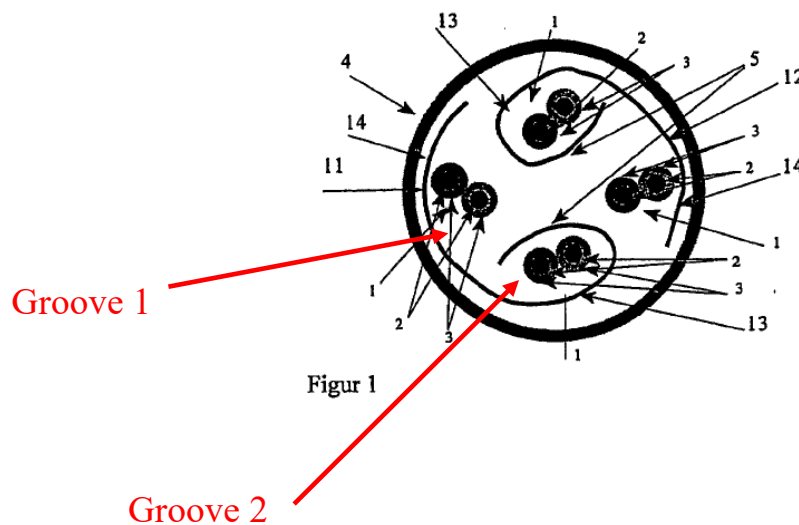
192. Third, SZ stranding of individual wires in a twisted pair (as opposed to simply SZ-stranding multiple sets of twisted pairs) would have been extremely uncommon as of 1999 (and even today). This is because an individual pair that was SZ-stranded would be highly susceptible to becoming unwound when moved or stretched. For this reason also a POSITA would understand references in the GmbH-866 patent to SZ stranding to be referring to stranding the sets of twisted pairs about a common axis in the finished cable, not to SZ-stranding the individual wires of each twisted pair.

193. Twisting (cabling or stranding) all the components of a cable about a central axis in the final cable assembly was the most common cable construction for data communications cables as of February 1999. *See* EX-1016 at 9-10; EX-1009 at Figs. 22-23, 11:28-31, 12:17-26; EX-1014 at 1:54-56, 2:4-5, 3:21-22.

194. GmbH-866 thus discloses this element.

- vi. [27.e] “wherein the configurable dielectric pair separator is arranged within the jacket to form at least two grooves.”

195. GmbH-866 discloses this element. Each of partial shieldings 11, 12 are arranged within the jacket (cable sheath 4) to form at least two grooves. *See* EX-1010 at Figs. 1-5. For example, Figure 1 discloses a pair of grooves formed by partial shielding 11. As discussed above, these partial shieldings have the shape of the number “6”. EX-1010 at 4. A first groove is located at the round portion of the shielding. A second groove is located at the curved end portion. This is demonstrated in annotated Figure 1 below:



EX-1010 at Fig. 1 (Annotated).

196. GmbH-866 thus discloses this element. For the reasons given above, a POSITA would understand GmbH-866 to disclose a cable with the elements recited in Claim 27 and anticipate this claim.

2. Claim 28: “The data communications cable as claimed in claim 27, wherein the configurable dielectric pair separator is arranged to provide a sufficient spacing between the first twisted pair of insulated conductors and the second twisted pair of insulated conductors so as to provide a desired crosstalk isolation between the first twisted pair of insulated conductors and the second twisted pair of insulated conductors.”

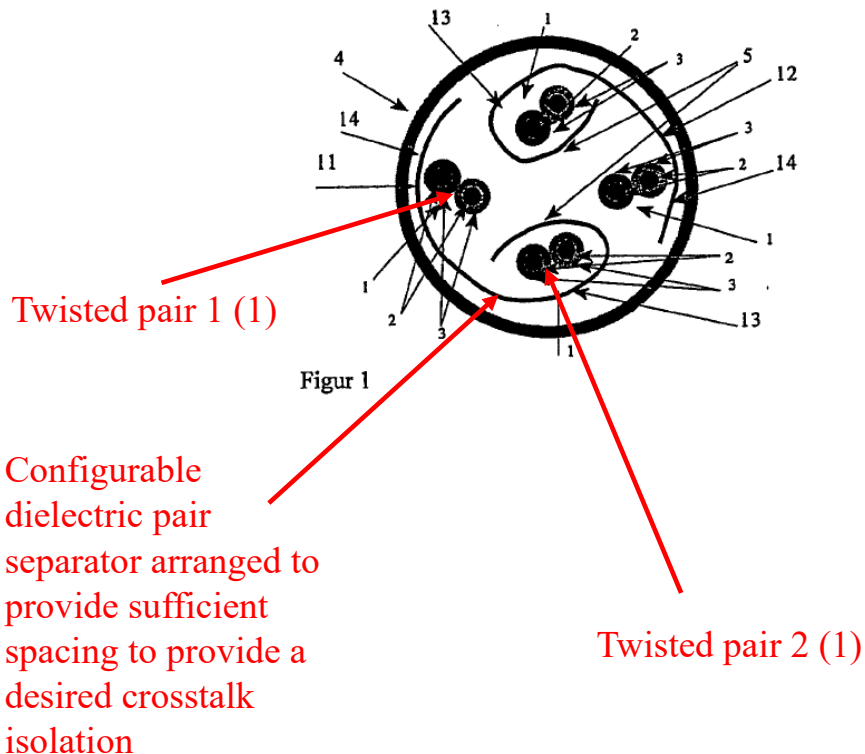
197. GmbH-866 teaches this claim element. GmbH-866 teaches that the partial shielding 11 (or partial shielding 12) (each of which is a *configurable dielectric pair separator*) is arranged to provide sufficient spacing between the first twisted pair of insulating conductors and the second twisted pair of insulating conductors so as to provide a desired crosstalk isolation between the first twisted pair of insulated conductors and the second twisted pair of insulated conductors.

198. GmbH-866 teaches that its shielding is used to achieve “optimized transfer properties” including “*low crosstalk*”. EX-1010 at 2. A POSITA would have understood that a cable providing “low crosstalk” is a desired crosstalk isolation, as crosstalk was understood to be undesired in a cable.

199. Each partial shielding creates sufficient spacing by “divid[ing] the cable cross section” into shielding sectors, with one twisted pair in each sector. EX-1010 at cl. 1; *see also id.* at 4 (“cable cross section is divided into four shielding sectors ... One conductor pair 1 extends in each of the shielding sectors”) and Figs. 1-5. The conductor pairs 1 are arranged with the shielding sectors to

provide the sufficient spacing between first and second twisted pairs to achieve a desired low crosstalk (*crosstalk isolation*). See EX-1010 at 4.

200. GmbH-866 discloses that the aluminum foil within the shielding is preferably between 20 and 60 μm . EX-1010 at 5. Laminating both sides of the aluminum foil with the dielectric plastic layer would increase the total thickness of the shielding. The partial shieldings in GmbH-866 are also curved to provide spacing between the twisted pairs.



It was known in the cable art that increasing and then maintaining the distance between adjacent twisted pairs effectively provides a desired crosstalk reduction.

See, e.g., EX-1023 at 3:17-24 (“The spacing of the pairs minimizes cross-talk between the pairs”); EX-1015 at 7:58-61 (“The portions of the buffer system maintain the conductor pairs spaced apart which improves crosstalk performance”).

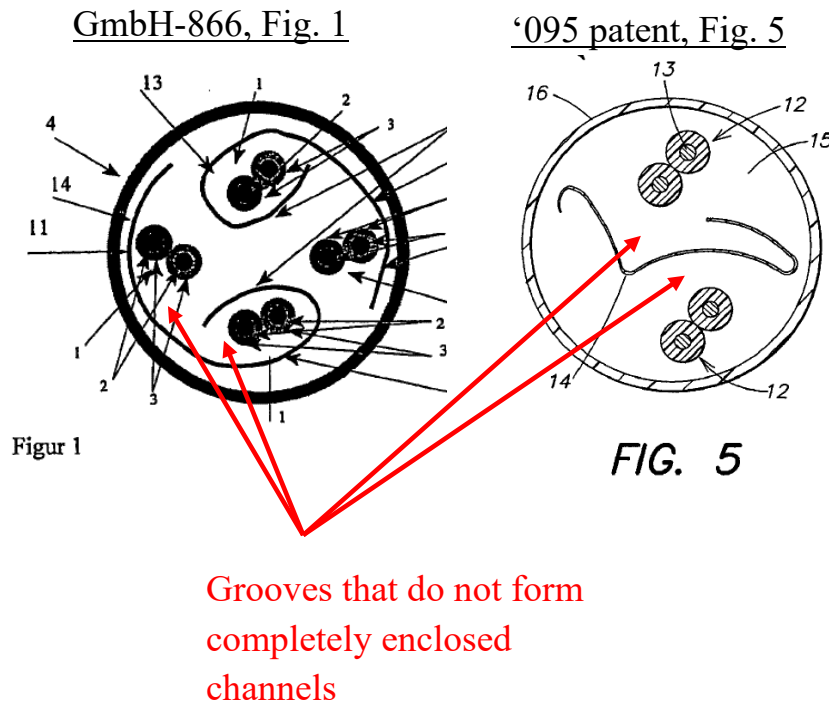
201. For the particular plastic laminated partial shieldings 11, 12 arrangements disclosed by GmbH-866, it provides sufficient spacing and isolation between the twisted pairs on each side of the shielding to result in the desired crosstalk isolation (e.g., the “low crosstalk”). *See* EX-1010 at 2. GmbH-866 compares the performance of its cable with partial shieldings to cables “having single-shielded conductor pairs” surrounding each pair. *Id.* Twisted pairs with shields completely surrounding each pair were known to have low crosstalk.

202. GmbH-866 thus discloses this element. For the reasons given above, a POSITA would understand GmbH-866 to disclose a cable with the elements recited in Claim 28 and anticipate this claim.

3. Claim 29: “The data communications cable as claimed in claim 27, wherein the at least two grooves do not form completely enclosed channels.”

203. GmbH-866 teaches this claim. For example, the grooves formed by partial shielding 11 in Figure 1 do not form completely enclosed channels. EX-1010 at Fig. 1. It is also notable to me that the grooves in shielding 11 in Figure 1 of

Gmbh-866 are similar to the grooves depicted in the '095 patent at Figure 5, which the '095 patent describes as having grooves that do not form completely enclosed channels:



EX-1010 at Fig. 1; EX-1001 at 5:6-7 (“As illustrated, the grooves 15 do not form completely enclosed channels”).

204. GmbH-866 thus discloses this element. For the reasons given above, a POSITA would understand GmbH-866 to disclose a cable with the elements recited in Claim 29 and anticipate this claim.

D. GROUND 4: A POSITA Would Have Been Motivated to Modify GmbH-866, with a Reasonable Expectation of Success, in view of Jachimowicz and/or Gingue (Claims: 30-33)

1. Claim 30: “The data communications cable as claimed in claim 27, wherein the configurable dielectric pair separator comprises a foamed polymer tape.”

205. GmbH-866 has all of the elements of independent claim 27, as I explained above. GmbH does not appear to have a construction “wherein the configurable dielectric pair separator comprises a foamed polymer tape,” as is stated by claim 30. This would have been an obvious modification to GmbH-886, though, particularly in view of the teachings of Jachimowicz and/or Gingue.

206. I summarized the teachings of Jachimowicz and Gingue above. *Supra*, §X.B.1, §IX.C, §IX.D. As I explained, Jachimowicz teaches foamed polymer tape, and Jachimowicz and Gingue teach the benefits of using a foamed polymer as a dielectric isolation/insulation component in communications cables. Jachimowicz teaches applying a layer or “tape made of foamed thermoplastic supported by a film such as Mylar or polypropylene” over a set of multiple twisted pairs in a telephone communications cable. EX-1014 at 2:46-54. Gingue teaches a “foamed polymeric material” that preferably comprises “foamed polyethylene or foamed polypropylene” (EX-1013 at Abstract, 4:22-36). *Supra*, §X.B.1, §IX.C. Gingue also teaches the beneficial properties of foamed polymer in communications

cables, including that foaming a polymer “achieves a favorable balance of electrical properties and flame retardance.” EX-1013 at 3:20-26.

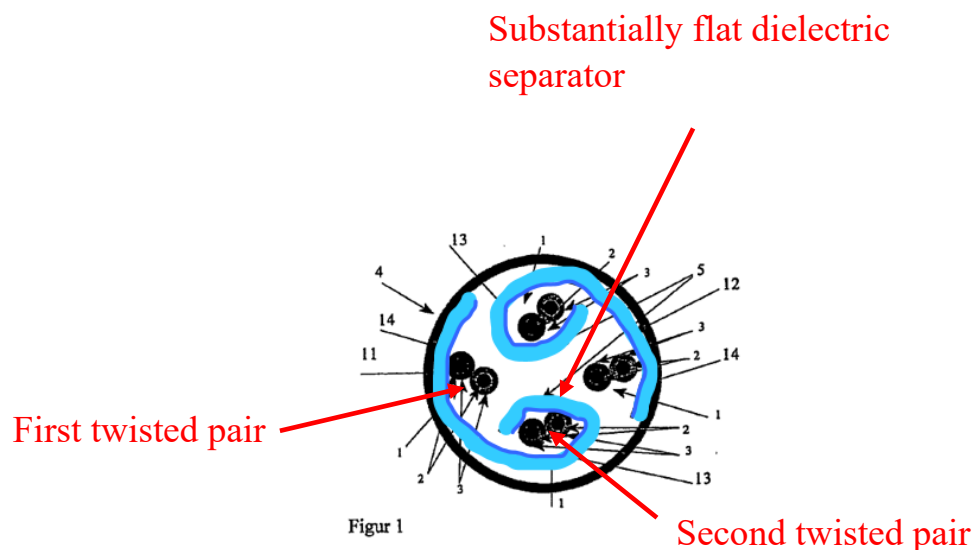
207. GmbH-866 teaches twisted pairs that are separated one from the other by a partial shielding 11, that is a “metal foil[] . . . laminated with plastic.” GmbH-866 at 5. In this respect, GmbH is like Roberts, which also teaches a metal foil laminated by plastic that separates twisted pairs that are on opposite sides. GmbH-866 at 5 (“shieldings 11, 12 preferably consist of metal foils, in particular, aluminum foils or aluminum foils laminated with plastics material”).

208. As I mentioned in my discussion of Roberts, it was also known that metal shielding around twisted pairs (such as that shown by both Roberts and GmbH-866) caused detrimental transmission loss. EX-1015 at 2:54-65 (“[A]s the electric and magnetic fields are confined [by shielding], capacitance . . . change[s] in such a way as to increase transmission loss.”). The metal shielding of GmbH-866 would have, like the shielding of Roberts, been expected to cause this detrimental transmission loss. Also, separating twisted pairs with a foamed polymer buffer to was already known in the art. *E.g.*, EX-1015 at Fig. 6 and cl. 19 (a “buffer” of foamed PVC separating twisted pairs).

209. As I also mentioned in my discussion of Roberts, there was market pressure in the communications cable industry to increase cable performance and

reliability, which meant trying to reduce problems like transmission loss, and to provide improved protection against dielectric breakdown.

210. Therefore a POSITA would have been motivated, with a reasonable expectation of success, to modify the cable taught by GmbH-866 to include a substantially flat foamed polymer tape (whether provided instead of a non-foamed plastic coating or in addition to a non-foamed plastic coating). I provide a conceptual illustration below:



EX-1010 at 1 (dielectric foamed polymer tape in blue).

211. There are at least three specific reasons a POSITA would be so motivated. **First**, to reduce transmission losses. **Second**, to provide enhanced protection against dielectric breakdown, and **third**, to improve the flame resistance of the cable.

212. As to the **first** and **second** reasons, I explained above with respect to Roberts why a POSITA would be motivated to add a foamed polymer tape, having the low dielectric constant as taught by Jachimowicz and Gingue, to a plastic-coated metal foil separator shield. *Supra*, §X.B. GmbH-866, like Roberts, discloses “shieldings” of plastic film-coated metal foil to separate twisted pairs. EX-1010 at 4 (“aluminum foils laminated with plastics material”). Therefore, a POSITA would have been motivated to make that modification—adding a low-dielectric constant foamed tape to the plastic coated metal “partial shieldings” 11 and/or 12 of GmbH-866, for the same reasons I explained with respect to Roberts. *Supra*, §X.B.

213. A POSITA would also be motivated to make the modification for a **third** reason: using a tape of foamed polymer, such as taught by Gingue, to the GmbH-866 laminated foil (either in place of or in addition to the plastic film coating on the foil) would have been expected to predictably improve the flame resistance of the GmbH-866 cable compared to using a solid (non-foamed) dielectric material. *E.g.*, EX-1013 at 3:20-26 (“Foaming also decreases the amount of flammable material employed for a given volume of material”), 4:37-39 (the foamed polymer can include an additive that further improves flame resistance).

214. It was known that flame resistance and low smoke generation were desirable for certain types of data communications cables, including the type of

communications cable taught by GmbH-866. EX-1013 at 2:1-4 (“in plenum applications for voice and data transmission, electrical conductors and cables should exhibit low smoke evolution . . .”); EX-1015 at 1:36-38 (“Because the cable may be used in occupied building spaces, flame retardance is also important”). A POSITA would expect the GmbH-866 cable to be suitable for indoor use. Indeed, there is nothing about the GmbH-866 cable that would indicate it is not, and such twisted pair cables were commonly used indoors. As Gingue explained, “foamed material is preferably employed to achieve a favorable balance of electrical properties and *flame retardancy*.” EX-1013 at 3:20-26 (emphasis added).

215. A POSITA would have had a reasonable expectation of success in modifying the partial shielding 11 and/or 12 of GmbH-866 to include a substantially flat foamed polymer tape, because of the substantial overlap in the technology discussed by GmbH-866, Jachimowicz and Gingue. Each of them teaches constructions of communications cables having copper wires, insulating materials, and cable jacketing. A POSITA would have expected to be able to predictably combine the teachings of these highly similar disclosures in the same technology area using only routine skill in the field. For example, GmbH already teaches a metal foil “laminated with plastics material.” EX-1010 at 5. A POSITA would have expected to be able to, without using anything more than routine skill,

substitute the non-foamed plastic coating GmbH-866 already teaches for a foamed polymer tape such as that described by Jachimowicz.

216. Alternatively, a POSITA would also have expected to be able to simply add the foamed polymer tape to the top of the plastic-coated foil shieldings during the cabling process, using known and routine cable manufacturing techniques.

217. Manufacturing the cable disclosed in GmbH-866 to include foamed polymer tape with or on partial shieldings 11, 12 also would not have required anything beyond ordinary, routine processes and engineering at the time. A POSITA would have expected to simply provide a foil member laminated with a substantially flat foamed polymer tape (such as that taught by Jachimowicz) through the die of a standard cabling machine, to form the foamed polymer tape-including shield into the final cable assembly in the same way the partial shieldings 11, 12 disclosed by GmbH-866 would be. I also note that foamed-polymer-coated aluminum shielding was known in the art. *See* EX-1027 at 2:50-52 (teaching an “expanded, porous polytetrafluoroethylene containing a thin layer of aluminum”). A POSITA also would have expected to be able to, alternatively, feed in one or two foamed polymer tapes on the outside of a partial shielding 11, 12 during the stranding process.

218. Further, a POSITA would have expected to be able to use the foamed polymer insulation layer described in Gingue as the plastic laminate described in GmbH-866, to obtain a predictable result and improved the cable in the same way as in Gingue. That is, a beneficial balance of improved electrical performance and flame retardance. EX-1013 at 3:20-26.

219. Thus, it is my opinion that it would have been obvious to modify GmbH-866, based on the teachings of Jachimowicz and Gingue, to have the configurable dielectric pair separator comprise a foamed polymer tape.

220. Thus, GmbH-866 in view of the teachings of Jachimowicz and Gingue renders this claim obvious.

2. Independent Claim 31

i. [31.pre] “A data communications cable comprising:”

221. GmbH-866 teaches this. *Supra*, §X.C.1.i.

ii. [31.a] “a plurality of twisted pairs of insulated conductors;

222. GmbH-866 teaches this. *Supra*, §X.C.1.ii.

iii. [31.b] “a configurable dielectric pair separator disposed between at least two of the plurality of twisted pairs of insulated conductors”

223. GmbH-866 teaches this. *Supra*, §X.C.1.iii.

- iv. **[31.c] “the configurable dielectric pair separator including a substantially flat dielectric tape formed of a foamed polymer;”**

224. GmbH-866 in combination with one or more of Jachimowicz and Gingue teaches that the configurable dielectric pair separator may include a substantially flat dielectric tape formed of a foamed polymer. *Supra*, §X.D.1. A POSITA would have been motivated to make this combination / modification, with a reasonable expectation of success, for the same reasons I explained above with respect to claim 30. *Supra*, §X.D.1.

225. Thus, it is my opinion that it would have been obvious to modify GmbH-866, based on the teachings of Jachimowicz and Gingue, to have the configurable dielectric pair separator include a substantially flat dielectric tape of a foamed polymer.

- v. **[31.d] “a jacket enclosing the plurality of twisted pairs of insulated conductors and the configurable dielectric pair separator; and”**

226. GmbH-866 teaches this. *Supra*, §X.C.1.iv.

- vi. **[31.e] “wherein the plurality of twisted pairs of insulated conductors and the configurable dielectric pair separator are twisted about a common axis to form a twisted pair cable.”**

227. GmbH-866 teaches this. *Supra*, §X.C.1.v.

228. Thus, GmbH-866 in view of the teachings of Jachimowicz and Gingue renders this claim obvious.

3. **Claim 32: “The data communications cable as claimed in claim 31, wherein the configurable dielectric pair separator is arranged to provide a sufficient spacing between the at least two twisted pairs of insulated conductors so as to provide a desired crosstalk isolation between the at least two twisted pairs of insulated conductors.”**

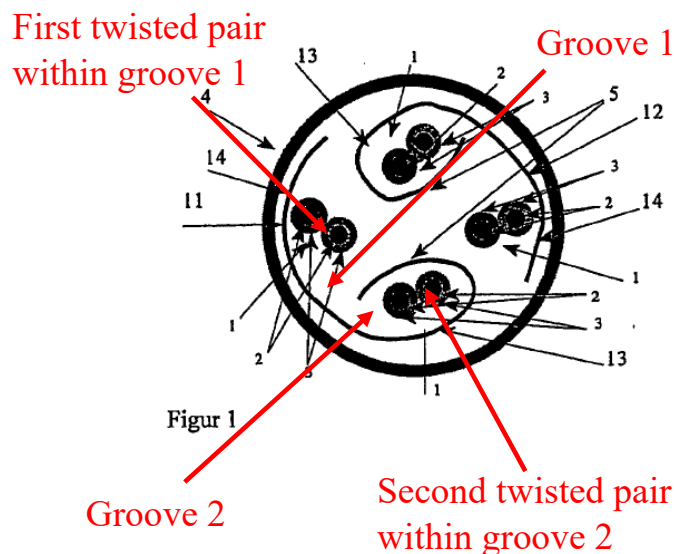
229. GmbH-866 teaches this, for the reasons I explained above with respect to claim 28. *Supra*, §X.C.2. I also note that modifying GmbH-866 to include a foamed polymer tape would provide and maintain an even greater spacing between a twisted pair on one side of the separator and a twisted pair on the other side. And as I explained above, maintaining a larger distance between twisted pairs reduces cross-talk between them. EX-1023 at 3:17-24 (“The spacing of the pairs minimizes cross-talk between the pairs”); EX-1015 at 7:58-61 (“The portions of the buffer system maintain the conductor pairs spaced apart which improves crosstalk performance”). Therefore, this obvious modification would result in an arrangement that provides an even larger amount of desirable cross talk isolation.

230. Thus, GmbH-866 in view of the teachings of Jachimowicz and Gingue renders this claim obvious.

4. **Claim 33: “The data communications cable as claimed in claim 31, wherein the configurable dielectric pair separator**

is arranged within the jacket to provide at least two grooves, at least one twisted pair of conductors being disposed within each of the at least two grooves.”

231. GmbH-866 teaches this. *Supra*, §X.C.1.vi. GmbH-866 further teaches that at least one twisted pair of conductors is disposed within each of the at least two grooves:



232. Thus, GmbH-866 in view of the teachings of Jachimowicz and Gingue renders this claim obvious.

E. **GROUND 5: A POSITA Would Have Been Motivated to Modify Roberts, with a Reasonable Expectation of Success, in View of One or More of GmbH-866, Jachimowicz, and Gingue (Claims 27-33)**

233. I explained above, Roberts teaches the use of twisted pairs. However, even if it did not teach that, it would have been an obvious thing to do.

234. GmbH-866 teaches a data communications cable assembly that is very similar to Roberts, having a plurality of insulated copper conductors separated by a plastic-coated metal shielding. *See generally* EX-1010. GmbH-866 teaches that insulated copper conductors are twisted pairs. *Id.* at 3 (“four pairs 1, each consisting of two isolated, stranded copper conductors 2 or wires”).

235. Jachimowicz also teaches a data communications cable that uses multiple twisted pairs of insulated conductors. Jachimowicz at 2:32-33 (“three pairs 10-14 [of insulated conductors] are each twisted with a different lay”); Fig. 2 (showing each twisted pair with a different lay), Fig. 4.

236. By 1999 and well before, twisting pairs of insulated conductors into multiple sets of “twisted pairs” was the most common and conventional way to provide insulated conductors in data communications cables. *E.g.*, EX-1019 at 1:10-15 (“A typical telephone cable is constructed of twisted pairs of metal conductors . . .”); EX-1016 at 7 (“Most of the cables within the scope of AT&T’s EC&W product line utilize the twisted pair construction.”); 9 (showing “pair twisting” as the first step in making cable core units); EX-1029 at 23 (“Twisted Pair Data Cables”), 25 (“Cables with twisted pairs are used where balanced signal transmission is required, together with low crosstalk”), 33 (Fig. 55.1: cross-section of telecommunication twisted pair cable); EX-1017 at 11 (“The most commonly used transmission media in present-day digital loop applications is twisted pair

metallic (copper) cable”); EX-1035 at 20 (“Insulated conductors twisted to form pairs with varying lays to minimize crosstalk and meet capacitance unbalance limitations.”). It was known to use twisted pairs of conductors instead of straight conductors because twisting the pairs of conductors helped to minimize or eliminate crosstalk and to decrease unbalanced mutual capacitance. EX-1016 at 7. Additionally, twisting pairs provides a mechanical advantage. The individual conductors of the pairs stay grouped together and maintain their shape when the cable is laid out.

237. To the extent Roberts is found to not expressly teach that the plurality of insulated conductors in the cables it teaches are provided as twisted pairs, it would have been an obvious and routine modification to configure the insulated conductors in Roberts as twisted pairs.

238. A POSITA would have been motivated to do this to get the known, predictable mechanical and electrical performance benefits of twisted pairs, and to avoid the known drawbacks of using a plurality of non-twisted pair insulated conductors in a data communications cable. For example, twisted pairs have the mechanical advantage of keeping the two conductors grouped together during the cabling process. Twisted pairs also have the electrical advantage of minimizing or eliminating crosstalk and decreasing unbalanced mutual capacitance. EX-1016 at

7. *See also* EX-1029 at 25 (“Cables with twisted pairs are used where balanced signal transmission is required, together with low crosstalk”).

239. A POSITA would have had a reasonable expectation of success in doing this because using *twisted* pairs in telephone cables such as that disclosed by Roberts was the most common, conventional way to construct such a cable. For example, patents were filed in the 1920s on telephone cables using twisted pairs. *See, e.g.*, EX-1020 at 2:55-57 (filed April 18, 1924; “A plurality of copper wires insulated with paper, cotton, silk, or other suitable materials, usually twisted together in pairs”); EX-1021 at 1:43-47 (filed Sept. 11, 1929; “assembling and twisting a plurality of twisted pairs of individual insulated electrical conductors into a single compact group or so called cable unit”). It would have been simple to feed twisted pairs through Roberts’ die plates. For example, AT&T produced a user’s guide showing twisted pairs being fed into die plates in a similar manner as Roberts. *Compare* EX-1016 at 9 *with* EX-1009 at Fig. 23. Further, there was nothing about Roberts’ specific cable that would make using twisted pairs unusually difficult or require anything other than routine skill.

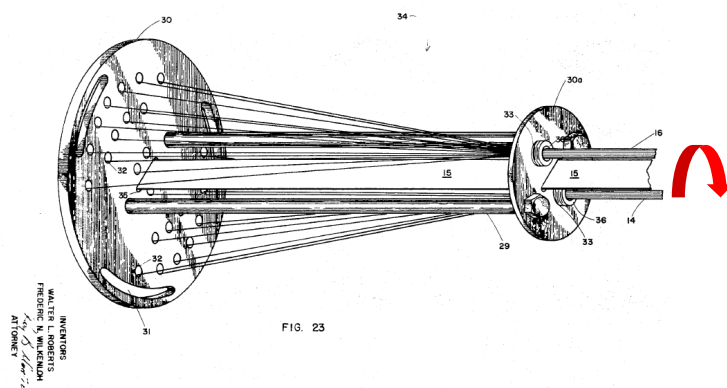
240. Thus, even if Roberts did not disclose the use of twisted pairs, it would have been obvious to modify Roberts based on the teachings of GmbH-866, Jachimowicz, and Gingue.

F. GROUND 6: A POSITA Would Have Been Motivated to Modify GmbH-866, with a Reasonable Expectation of Success, in View of One or More of Roberts, Jachimowicz, and Gingue (Claims 27-33)

241. As I explained above, GmbH-866 teaches that its twisted pairs and plastic-coated shielding are all twisted around a common axis. However, even if it did not teach that, it would have been an obvious thing to do.

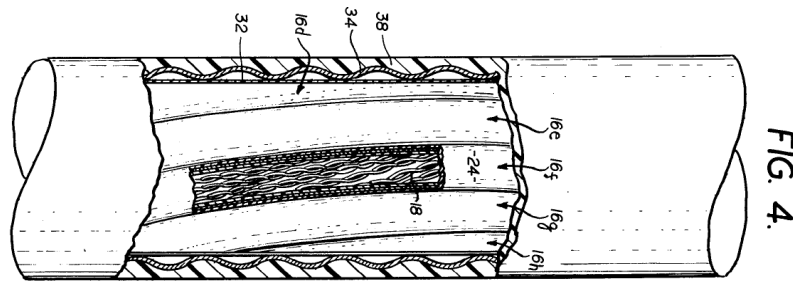
242. As explained above, GmbH-866 discloses “stranding” in the “SZ standing method,” which suggests to a POSITA twisting the pairs of conductors and separators about a common axis, as I discussed above in Ground 3.

243. Also, as I explained above, Roberts teaches twisting (cabling) conductor pairs 14 and 16 and the plastic-coated metal shield together about a common axis to form the cable assembly. EX-1009 at 12:14-29 (forming a “*twisted composite* formed from elements (14), (15), and (16)” (emphasis added). Roberts describes and shows a cabling tool to accomplish this:



EX-1009 at 11:70-12:38, Fig. 23.

244. Jachimowicz similarly teaches sets of twisted pairs such as pairs 10, 12 that are bundled together into units 16, with the multiple units 16 are then “cabled” together into the overall cable 30. EX-1014 at 3:2-11, 3:18-24, Fig. 3; *see also id.* 3:41-42 and Fig. 4 (“units 16d, 16e, 16f, 16g . . . are cabled with a long lay”); cl. 1; 2:4-5 (“identical shield units are then cabled together”):



Id. at Fig. 4.

245. Further, twisting the components of a cable about a common axis to form the final assembled cable, known in the art as “cabling,” was the most common way to construct cables that included twisted pair wires, by 1999 and also long before. *See* EX-1016 at 9-10 (showing multi-unit cable cores being “cabled or ‘stranded’ together by larger cabling machines”).

246. There was good reason for this. By 1999 (and long before), it was known that twisting (cabling) the components of a cable together about a common axis was generally desirable and beneficial because it increased the strength and flexibility of the finished cable and also improved impedance uniformity. *E.g.*, EX-1016, 50-51; EX-1028 at 4:15-22 (spacer and twisted pairs are twisted about a

common axis to “hold[] these cable components together [and] improve[] the impedance uniformity of the cable”).

247. For example, twisting cable components about a common axis was known to be the most effective way to avoid issues resulting from the difference between the inside and outside diameters of the cable. When cables bend, it is preferred that the stresses on the twisted pairs within the cables are the same independent of whether the twisted pair is on the inside of a bend or on the outside of a bend. A twisted pair at the outside of a bend is subjected to tensile stress which could result in mechanical deformation. A pair at the inside of a bend is subjected to compression stress, which can also cause mechanical deformation such as buckling. The signals transmitted over that twisted pair may be degraded. This can also result in degraded crosstalk performance and low return loss⁶.

248. Twisting the cable components about a common axis (“cabling” the components) avoids this risk. With the components of the cable twisted or cabled about a common axis, the twisted pair(s) will behave somewhat as a spiral spring

⁶ Return loss is the reflection of electrical waves traveling down a wire from the transmitter to the receiver. Ideally, the return loss would be high, meaning all of the energy is received by the receiver and no energy is reflected back to the transmitter. *See* EX-1031 at 5 (“return loss 1. The difference between the power incident upon a discontinuity in a transmission system and the power reflected from the discontinuity.”)

and reduce mechanical stress since the pairs are sometimes on the outside and sometimes on the inside, which eliminates this issue.

249. Further, cables having all their components twisted (stranded or cabled) about a common axis cables were known to be less stiff and easier to bend than straight cables since the cable components are subjected to less tensile and compression stress when the cable is bent. For example, a spring made out of the same wire is more flexible than the wire itself. The helix in the wire is a spring like structure. The tensile and compression stresses can cause the individual conductors of the pairs to separate if the pairs are not twisted (cabled) about a common axis.

250. Stranding everything together also improves conductor spacing uniformity and impedance uniformity.

251. Therefore a POSITA would have been motivated, with a reasonable expectation of success, to twist the components of the GmbH-866 cable, including the twisted pairs and the foil shield(s), about a common axis to obtain these known and predictable benefits.

252. A POSITA would have had a reasonable expectation of success. As explained above, twisting the components about a common axis (“cabling”) was a well-known, common, and predictable technique long before 1999 and in fact was the most common way to assemble twisted pair cables. *See, e.g.*, EX-1016 at 9-10; EX-1009 at Figs. 22-23, 11:28-31, 12:17-26; EX-1014 at 1:54-56, 2:4-5, 3:21-22.

Further, there is nothing about the GmbH-866 cable that would have prevented a POSITA from doing the conventional thing and cabling the components (twisting them about a common axis), nor was there anything about the GmbH-866 construction that would make cabling the components require anything more than routine skill in the art.

253. Thus, even if GmbH-866 did not disclose that its twisted pairs and plastic-coated shieldings are twisted around a common axis, it would have been obvious to modify GmbH-866 based on the teachings of Roberts, Jachimowicz, and Gingue.

G. GROUND 7: Yanagida Anticipates Claims 27-29

1. Independent Claim 27

i. [27.pre] “1. A data communications cable comprising:”

254. I understand that this claim element does not limit the claim.

255. Even if it did, Yanagida teaches an alternately stranded “communications cable.” EX-1012 at 1[col.1]. A POSITA would understand a communications cable that includes twisted pairs as taught by Yanagida to include data communications cables. For example, T1 was introduced in 1962. T1 was a carrier system used to connect cities 10 to 50 miles apart. EX-1024 at 1:20-25. Such carrier systems used multipair cables such as the cable taught by Yanagida. EX-

1024 at 1:15-18. Certainly by the 1990s, a POSITA would understand discussion of a communications cable, such as that described by Yanagida, to include data communication cable.

256. Yanagida thus discloses this element.

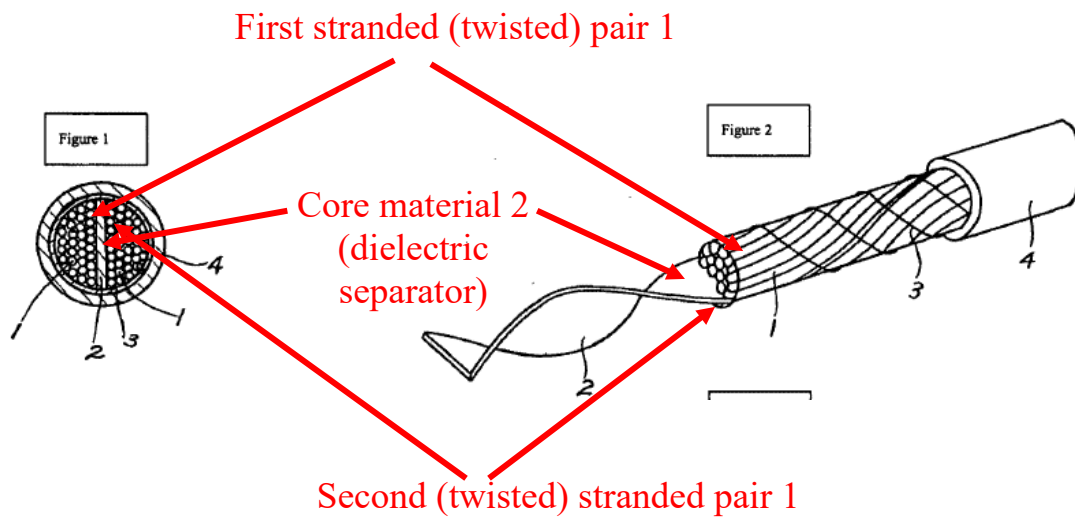
- ii. **[27.a] “a first twisted pair of insulated conductors; a second twisted pair of insulated conductors;”**

257. Yanagida discloses a first and a second twisted pair of insulated conductors. Yanagida explains it pertains to cables with a plurality of “strands of insulated or pairs thereof” that run along the surface of the core material. EX-1012 at 1[col.1]; *see also id.* (element 1 can be where “insulated wires are twisted together”); *see also* EX-1055 at 1 (“stranded pairs”). The terms “stranded pairs” and “twisted pairs” are used synonymously in the industry.

258. Yanagida thus discloses this element.

- iii. **[27.b] “a configurable dielectric pair separator that separates the first and second twisted pairs of conductors, the configurable dielectric pair separator being substantially flat;”**

259. Yanagida teaches a configurable dielectric core material 2 (*configurable dielectric pair separator*) that separates the first and second twisted pairs of conductors. The core material is substantially flat prior to twisting. I indicate this on the figure below:



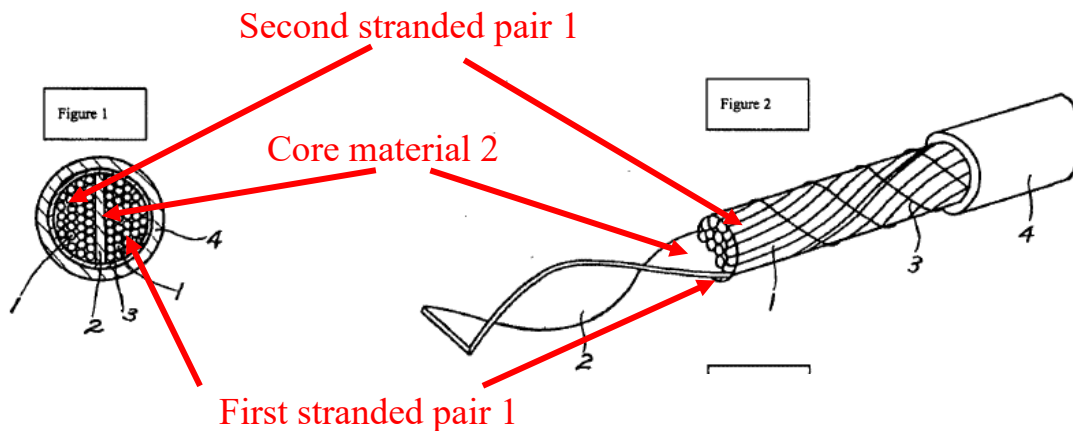
EX-1012 at 1[col.1].

260. First, Yanagida teaches a core material 2 made of plastic. EX-1012 at 1[col.1] (core material 2 formed from a “flat plate-shaped hard plastic”). A POSITA would understand such material to be a dielectric. As discussed above, plastics are dielectric materials. *Supra*, §VI.D; EX-1031 at 4. Dielectric material is another term for insulator. *See* EX-1031 at 4.

261. Second, Yanagida’s core material 2 is configurable. The core material is thermally formed from a substantially “flat” plate body. EX-1012 at 1[col.1], Figs. 1, 2. The process includes heat-forming the core material 2 by “twisting a flat plate-shaped hard plastic, or the like, while maintaining a given temperature.” *Id.* Thus Yanagada teaches, the “[core material 2] is formed in a reciprocatingly twisted state.” *Id.* As I noted above, I understand that “configurable” does not mean that the separator needs to be reconfigurable or continue to remain

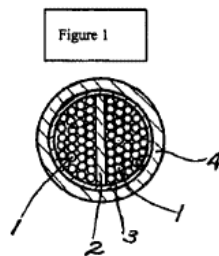
configurable in the finished cable; rather it need only be capable of forming or arrangement when the cable is being formed. *Supra*, §VIII.D. I also note that a POSITA would consider heat-forming a cable component, as Yanagida teaches, to be something that was done at normal manufacturing temperatures.

262. Third, core material 2 separates the first and second twisted pairs of conductors. The twisted pairs run on the facings of the core material. EX-1012 at 1[col.1] and Figs. 1 and 2. This is shown in annotated Figures 1 and 2 below:



Id. at Figs. 1, 2 (Annotated).

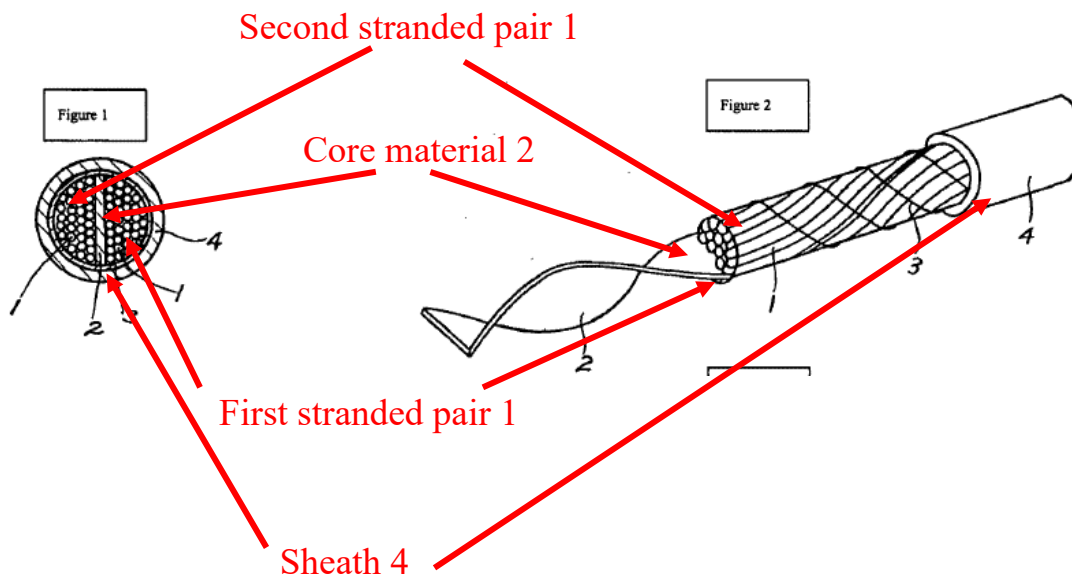
263. Fourth, the core material is substantially flat prior to the core material being twisted into its final “reciprocatingly twisted shape.” EX-1012 at 1. The core material is initially a “flat plated-shaped” member prior to being thermally formed into a helical separator. *Id.* A POSITA would understand that a plate body is substantially flat. The core material 2 is also substantially flat even in a cross-section taken through the finished cable, as shown in Yanagida Figure 1:



264. Yanagida thus discloses this element.

- iv. [27.c] “a jacket enclosing the first and second twisted pairs of insulated conductors and the dielectric pair separator; and”

265. Yanagida discloses a sheath (*jacket*) that encloses the stranded pairs (*first and second twisted pairs of insulated conductors*) and the core material (*dielectric pair separator*). After the core material is formed and the stranded pairs are run down along its surfaces, the outer periphery of Yanagida’s cable is “covered with a cable sheath 4” (*jacket*). EX-1012 at 1[col.1]; *see also id.* (“a cable sheath 4 are produced on the outer periphery of the wire core that is produced in this way”). The final assembled composition of the Yanagida cable is show in annotated figures 1 and 2 below:



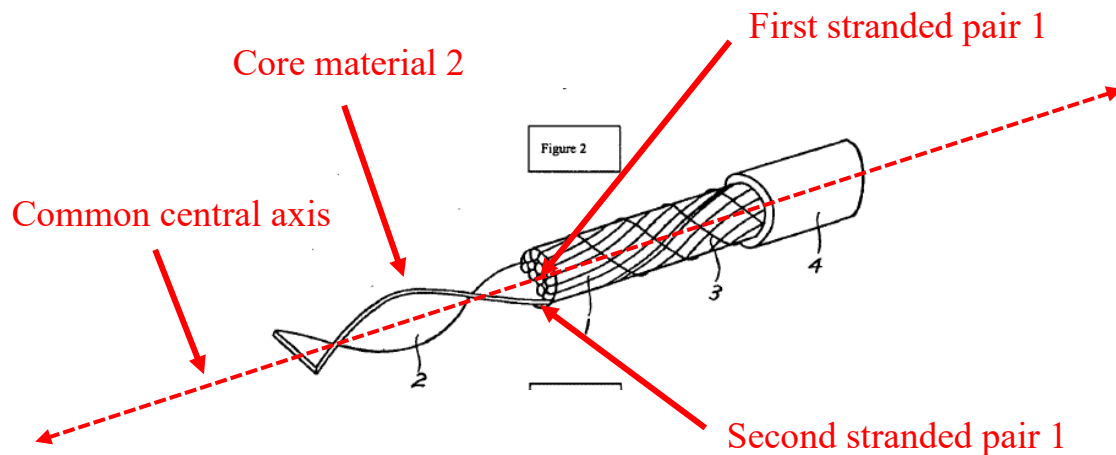
Id. at Figs. 1, 2 (Annotated).

266. Yanagida thus discloses this element.

- v. [27.d] “wherein the configurable dielectric pair separator, the first twisted pair of insulated conductors and the second twisted pair of insulated conductors are twisted about a common central axis to form a twisted pair cable;”

267. Yanagida’s core material (*configurable dielectric pair separator*) and stranded pairs (*first and second pairs of insulated conductors*) are twisted about a central axis. The separator is formed by twisting the facing of the core material along the longitudinal direction. EX-1012 at 1, Fig. 2. The stranded pairs are run along the surface of the separator. *Id.* This results in the separator and the stranded

pairs being twisted about a center axis. *Id.* This is shown in annotated Figure 2 below:



Id. at Fig. 2 (Annotated).

268. Yanagida thus discloses this element.

- iv. [27.e] “and wherein the configurable dielectric pair separator is arranged within the jacket to form at least two grooves.”

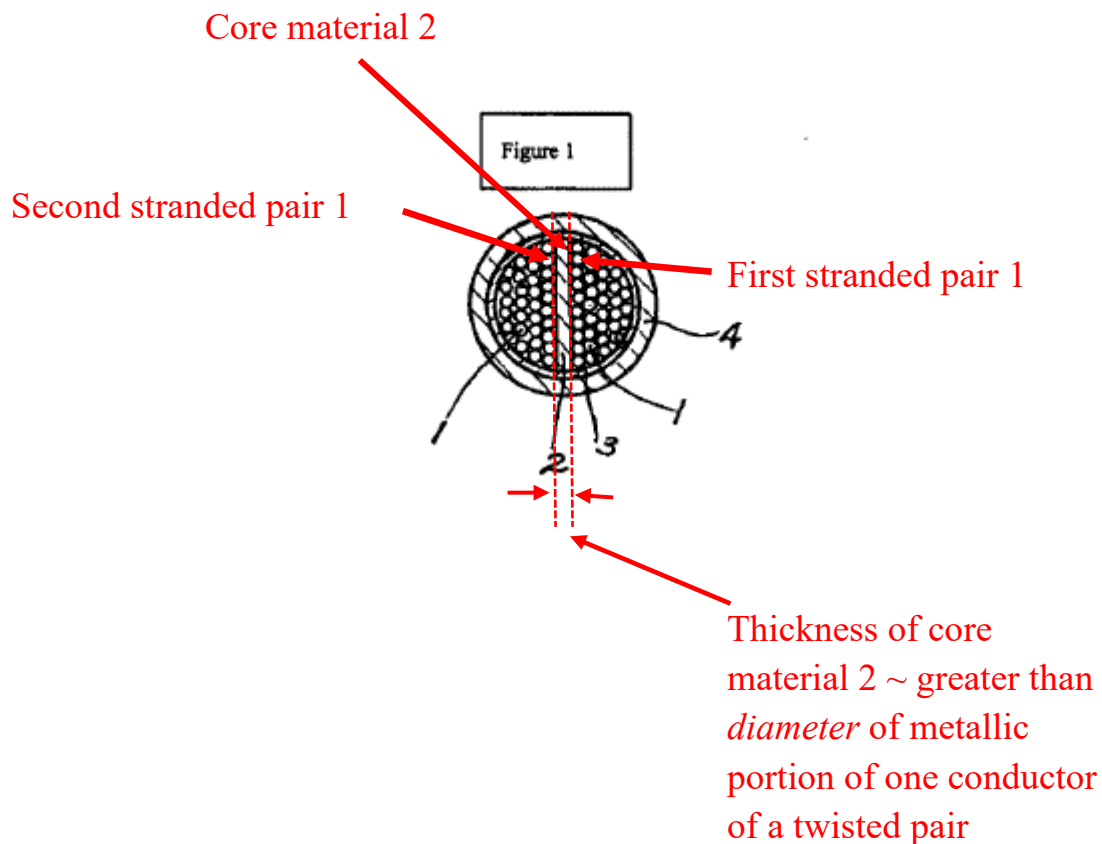
269. If the phrase “separator is arranged within the jacket to form at least two grooves” is understood to mean even configurations where the separator is straight in cross section and would only form a “groove” if viewed in conjunction with part of the cable sheath, then Yanagida discloses this element. Yanagida’s core material (*configurable dielectric pair separator*) is arranged such that a first twisted pair runs along one surface of the core material, and a second twisted pair runs along the other surface of the core material. EX-1012 at 1, Figs. 1, 2. This

results in each twisted pair running in a D-shaped space created between one surface of the core material 2 and the interior surface of the cable sheath 4.

270. Yanagida thus discloses this element. For the reasons given above, a POSITA would understand Yanagida to disclose a cable with the elements recited in Claim 27 and anticipate this claim.

2. **Claim 28: “The data communications cable as claimed in claim 27, wherein the configurable dielectric pair separator is arranged to provide a sufficient spacing between the first twisted pair of insulated conductors and the second twisted pair of insulated conductors so as to provide a desired crosstalk isolation between the first twisted pair of insulated conductors and the second twisted pair of insulated conductors.”**

271. Though not discussed by Yanagida, Yanagida shows a dielectric separator (core material 2) arranged in a way that would provide a sufficient spacing to provide a desired cross talk isolation between a stranded pair on one side of the core material and a stranded pair on the other side. Yanagida’s core material 2 is arranged to both physically separate such pairs, and to provide a significant distance between a stranded pair on one side of the core material 2 and a stranded pair on the other side. I have illustrated this below:



EX-1012 at Fig. 1.

272. Yanagida's core material is described as "hard plastic." Yanagida, 1. Such a material would have enough mechanical integrity to maintain the first and second stranded pairs in a physically separated state and prevent neighboring twisted pairs on either side of the core material from nesting.

273. Also, as I explained previously, it was known in the art that increasing and then maintaining the distance between adjacent twisted pairs effectively reduced crosstalk between them. *E.g.*, EX-1023 at 3:17-24 ("The spacing of the pairs minimizes cross-talk between the pairs . . . "); EX-1015 at 7:58-61 ("The

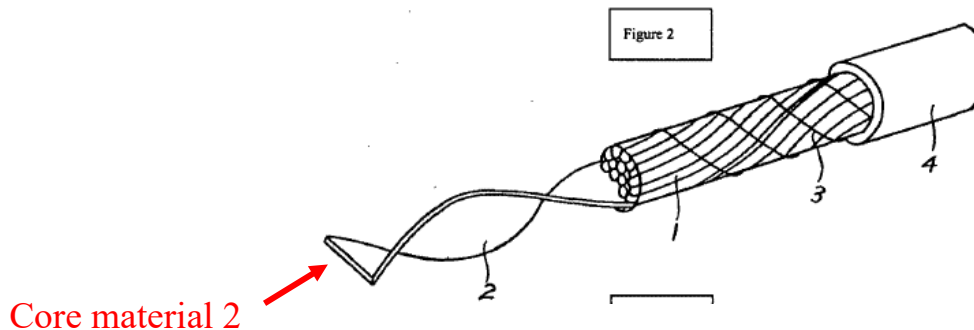
portions of the buffer system maintain the conductor pairs spaced apart which improves crosstalk performance”). As an example, the Beggs reference teaches a cable buffer between a first and second twisted pair with a buffer thickness “equal at least to the radius of the metallic portion” of the conductor wire, and the Beggs patent is directed to cables “suitable for high frequency data transmission” with adequate “crosstalk” isolation. EX-1015 at 6:10-14, 1:39-45. The arrangement shown by Yanagida indicates a spacing significantly greater than. Yanagida, in fact, indicates that the separator (core material 2) provides a spacing between first and second stranded pairs that is greater even than the *diameter* of a metal conductor wire (i.e. more than *twice* the radius of the conductor).

274. For at least these reasons, a POSITA would understand that this arrangement of the core material 2 (dielectric pair separator) would provide a sufficient spacing between the first stranded pair on one side of the separator and the second stranded pair on the other side to provide a desired crosstalk isolation between those pairs.

275. Yanagida thus discloses this element. For the reasons given above, a POSITA would understand Yanagida to disclose a cable with the elements recited in Claim 28 and anticipate this claim.

3. **Claim 29: “The data communications cable as claimed in claim 27, wherein the at least two grooves do not form completely enclosed channels.”**

276. If the “arranged within the jacket to form at least two grooves” part of claim 27.e can include even configurations where the separator is straight in a radial cross section in the final assembled cable, then Yanagida also discloses the limitation of claim 29. Yanagida’s core material 2 would not (itself) form completely enclosed channels. As shown in Figure 1 below, the helical core material 2 does not surround the stranded pairs



EX-1012 at Fig. 1 (Annotated).

277. Yanagida thus discloses this element. For the reasons given above, a POSITA would understand Yanagida to disclose a cable with the elements recited in Claim 29 and anticipate this claim.

H. GROUND 8: A POSITA Would Have Been Motivated to Modify Yanagida, with a Reasonable Expectation of Success, in View of Jachimowicz and/or Gingue (Claims 30-33)

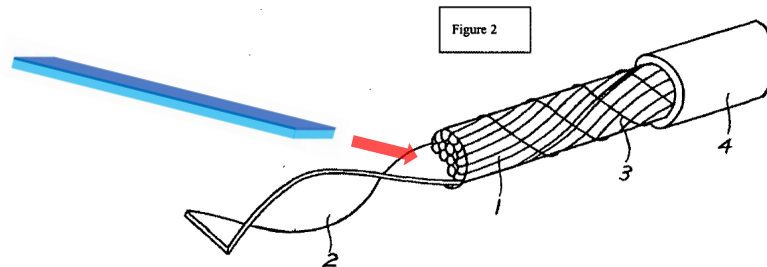
- 1. Claim 30: “The data communications cable as claimed in claim 27, wherein the configurable dielectric pair separator comprises a foamed polymer tape.”**

278. Yanagida teaches all the elements of independent claim 27, as explained above in Ground 7. Yanagida does not disclose the further limitation “wherein the configurable dielectric pair separator comprises a foamed polymer tape,” as required by claim 30. This would have been an obvious modification to Yanagida, particularly in view of the teachings of Jachimowicz and/or Gingue.

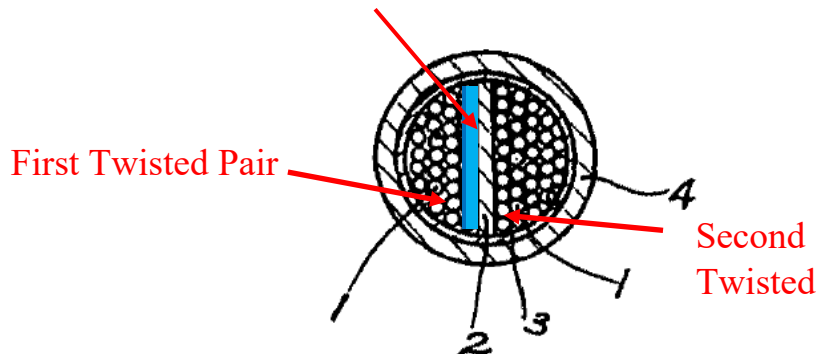
279. I summarized the teachings of Jachimowicz and Gingue above. *Supra*, §X.B.1, §IX.C, §IX.D. As I explained, Jachimowicz teaches applying a layer or “tape made of foamed thermoplastic supported by a film such as Mylar or polypropylene” over a set of multiple twisted pairs in a telephone communications cable. EX-1014 at 2:46-54. Gingue teaches a “foamed polymeric material” that preferably comprises “foamed polyethylene or foamed polypropylene” (EX-1013 at Abstract, 4:22-36). *Supra*, §X.B.1, §IX.C. Gingue also teaches the beneficial properties of foamed polymer in communications cables, including that foaming a polymer “achieves a favorable balance of electrical properties and flame retardance.” EX-1013 at 3:20-25.

280. In view of the teachings of Jachimowicz and Gingue, a POSITA would have been motivated, with a reasonable expectation of success, to modify Yanagida by laying foamed polymer tape alongside Yanagida’s core material 2, at the same time that the twisted pairs were laid. I illustrate a conceptual example below:

Foamed polymer tape
Yanagida communications
cable assembly



Dielectric separator comprises a foamed polymer tape



281. Yanagida teaches twisted pairs (or groups of twisted pairs) that are separated by a plastic “core material 2.” EX-1012 at 1[col.1], Figs. 1, 2. In this respect, Yanagida is like Roberts, which also teaches a separator that separates twisted pairs (or groups of twisted pairs) opposite sides of the separator. As I mentioned in my discussion of Roberts, there was market pressure in the communications cable industry to increase cable performance and reliability. This

meant trying to reduce known problems like transmission loss and crosstalk. A POSITA would have been motivated, with a reasonable expectation of success, to modify the dielectric separator taught by Yanagida by adding foam layers to predictably obtain those benefits.

282. In particular, the modification would have been expected to predictably improve the electrical performance of the cable in two ways. **First**, adding foamed polymer tape alongside Yanagida's core material 2 would have been expected to provide improved electrical performance by reducing the capacitance between the groups of twisted pairs. Current leakage arises when two conductors are separated by a dielectric material, forming a capacitor. If an alternating current is applied to the conductor, some current will flow through the capacitor resulting in some current loss. This is a common problem in any kind of transmission line. Such current leakage would be expected to happen in the Yanagida cable, for example between a twisted pair on one side of the core material 2 and a twisted pair immediately on the other side.

283. Reducing the capacitance between the conductors reduces the amount of current that is leaked (and therefore decreases the transmission losses of the cable). There were several known ways to reduce capacitance: (1) lowering the dielectric constant of the material between the conductors, (2) increasing the

distance between the conductors (e.g., between the copper conductors of adjacent twisted pairs), and (3) reducing the area of the conductors.⁷

284. A POSITA would have expected the addition of the dielectric foam tape material taught by Gingue and/or Jachimowicz to predictably reduce the capacitance, and thus the leakage current between the groups of twisted pairs. First, the foam tape would decrease the dielectric constant between the twisted pairs on either side of the separator. Foaming was known to enhance electrical performance by reducing the dielectric constant of the dielectric material. *See* EX-1013 at 3:20-26 (“the electrical performance of an insulating material is enhanced by foaming or expanding the corresponding solid material.”); *Id.* at 2:11-13 (explaining that enhanced electrical performance means “*low dielectric constant* and low dissipation factor.” (emphasis added)); *see also* EX-1026 at 3:21-24 (“Foam heat-resistant plastic tapes . . . are desirable where high dielectric strength is needed between the sheath and the cable core”). Foaming reduces the dielectric constant (thereby enhancing electrical performance) because it traps air, which has a very low dielectric constant, in the material. Second, adding foamed polymer tape would predictably increase the distance between conductors (the twisted pairs) on

⁷ As an example, the capacitance of a parallel plate capacitor is: $C = \epsilon_0 \frac{A}{d}$ where C is the capacitance, ϵ_0 is the dielectric constant, A is the area of the parallel plates, and d is the distance between the plates.

either side of the separator, due to the added thickness of the foamed polymer tape (foaming “expands” the polymer, by adding air pockets). This would also predictably further decrease the capacitance between the twisted pairs on either side of the separator.

285. **Second**, a POSITA would have known that adding a foamed polymer tape layer on Yanagida’s core material 2 would predictably (and beneficially) further decrease crosstalk between the two groups of twisted pairs on opposite sides of the separator. Crosstalk was known to negatively affect cable performance. The foamed polymer tape would have been expected to increase the thickness of the separator (due to the thickness added to the separator by the foamed tape), thereby providing increased physical distance between the twisted pairs on either side of the separator. It was known in the art that increasing and then maintaining the distance between adjacent twisted pairs effectively reduced crosstalk between them. *See, e.g.*, EX-1023 at 3:17-24 (“The spacing of the pairs minimizes cross-talk between the pairs”); EX-1015 at 7:58-61 (“The portions of the buffer system maintain the conductor pairs spaced apart which improves crosstalk performance”).

286. **Additionally**, adding a tape made of a flame-retardant foamed polymer, such as taught by Gingue, to Yanagida’s plastic core material would have been expected to predictably improve the flame resistance of Yanagida’s cable.

E.g., EX-1013 at 4:37-39 (the foamed polymer can include an additive that further improves flame resistance). It was known that certain data communications cables should be flame resistant. *Id.* at 2:1-4 (“in plenum applications for voice and data transmission, electrical conductors and cables should exhibit low smoke evolution . . .”); EX-1015 at 1:36-38 (“Because the cable may be used in occupied building spaces, flame retardance is also important”). This is particularly important as flame and smoke can spread down cables throughout a building. EX-1013 at 1:34-36. A POSITA would expect Yanagida’s cable to be suitable for indoor use. Indeed, there is nothing about Yanagida’s cable that would indicate it is not, and such twisted pair cables were commonly used indoors.

287. A POSITA would have had a reasonable expectation of success in modifying Yanagida to lay foamed polymer tape alongside the core member 2 given the substantial overlap in the technology discussed by Yanagida, Jachimowicz and Gingue. Each of the references teach constructions of communications cables having copper wires, and therefore a POSITA would have expected to be able to predictably combine the teachings using only routine skill in the field. Doing so would have been straightforward and would not have required any skill beyond routine engineering.

288. For example, laying a foamed polymer tape alongside Yanagida’s twisted core material 2 as part of the manufacturing process would have been

considered routine, and a POSITA would have expected to be able to feed the foamed polymer tape into the cable assembly alongside the core material 2 as the twisted pairs of wires were added. Yanagida teaches that the twisted pair wires are “longitudinally run along [] surfaces of core material 2.” EX-1012 at 1.

289. Thus, it is my opinion that it would have been obvious to modify Yanagida, based on the teachings of Jachimowicz and/or Gingue, to have the configurable dielectric pair separator comprise a foamed polymer tape.

290. Thus, Yanagida in view of the teachings of Jachimowicz and/or Gingue renders this claim obvious.

2. Independent Claim 31

i. [31.pre] “A data communications cable comprising:”

291. Yanagida teaches this. *Supra*, §X.G.1.i.

ii. [31.a] “a plurality of twisted pairs of insulated conductors;”

292. Yanagida teaches this. *Supra*, §X.G.1.ii.

iii. [31.b] “a configurable dielectric pair separator disposed between at least two of the plurality of twisted pairs of insulated conductors”

293. Yanagida teaches this. *Supra*, §X.G.1.iii.

- iv. **[31.c] “the configurable dielectric pair separator including a substantially flat dielectric tape formed of a foamed polymer;”**

294. Yanagida in combination with one or more of Jachimowicz and Gingue teaches that the configurable dielectric pair separator may include a substantially flat dielectric tape formed of a foamed polymer. *Supra*, §X.H.1. A POSITA would have been motivated to make this combination for the same reasons I explain with respect to claim 30.

295. Thus, it is my opinion that it would have been obvious to modify Yanagida, based on the teachings of Jachimowicz and Gingue, to have the configurable dielectric pair separator including a substantially flat dielectric tape formed of a foamed polymer.

- v. **[31.d] “a jacket enclosing the plurality of twisted pairs of insulated conductors and the configurable dielectric pair separator; and”**

296. Yanagida teaches this. *Supra*, §X.G.1.iv.

- vi. **[31.d] “wherein the plurality of twisted pairs of insulated conductors and the configurable dielectric pair separator are twisted about a common axis to form a twisted pair cable.”**

297. Yanagida teaches this. *Supra*, §X.G.1.v.

298. Thus, Yanagida in view of the teachings of Jachimowicz and Gingue renders this claim obvious.

2. **Claim 32: “The data communications cable as claimed in claim 31, wherein the configurable dielectric pair separator is arranged to provide a sufficient spacing between the at least two twisted pairs of insulated conductors so as to provide a desired crosstalk isolation between the at least two twisted pairs of insulated conductors.”**

299. Yanagida teaches this, for the reasons I explained above with respect to claim 28. *Supra*, §X.G.2. I also note that modifying Yanagida to include a foamed polymer tape alongside the helical core material 2 would provide and maintain an even greater spacing between a twisted pair on one side of the separator and a twisted pair on the other side. And as I explained above, maintaining a larger distance between twisted pairs reduces crosstalk between them. EX-1023 at 3:17-24 (“The spacing of the pairs minimizes cross-talk between the pairs”); EX-1015 at 7:58-61 (“The portions of the buffer system maintain the conductor pairs spaced apart which improves crosstalk performance”). Therefore, this obvious modification would result in an arrangement that provides an even larger amount of desirable cross talk isolation.

300. Thus, Yanagida in view of the teachings of Jachimowicz and Gingue renders this claim obvious.

3. **Claim 33: “The data communications cable as claimed in claim 31, wherein the configurable dielectric pair separator**

is arranged within the jacket to provide at least two grooves, at least one twisted pair of conductors being disposed within each of the at least two grooves.”

301. If the claim phrase “separator is arranged within the jacket to form at least two grooves” is construed to include even configurations where the separator is straight in a radial cross section, then Yanagida teaches this, as I explained with respect to claim element [27.e] above. *Supra*, §X.G.1.iv. Yanagida explains that twisted pairs run along the surface of the core material, so if Yanagida has two grooves, then at least one twisted pair is in each groove. EX-1012 at 1.

302. Thus Yanagida in view of the teachings of Jachimowicz and Gingue renders this claim obvious.

XI. Conclusion

303. In signing this declaration, I understand that the declaration will be filed as evidence in the contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in this case and that that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

304. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and

that these statements were 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.

In Support of Inter Partes Review
of U.S. Patent No. 6,570,095

Executed on: June 13, 2023

Kenneth Cornelison
Kenneth Cornelison

Claims Listing Appendix
U.S. Patent No. 6,570,095
Challenged Claims

Designation	Claim 27
Element 27.pre	27. A data communications cable comprising:
Element 27.a	a first twisted pair of insulated conductors; a second twisted pair of insulated conductors;
Element 27.b	a configurable dielectric pair separator that separates the first and second twisted pairs of conductors, the configurable dielectric pair separator being substantially flat;
Element 27.c	a jacket enclosing the first and second twisted pairs of insulated conductors and the dielectric pair separator; and
Element 27.d	wherein the configurable dielectric pair separator, the first twisted pair of insulated conductors and the second twisted pair of insulated conductors are twisted about a common central axis to form a twisted pair cable, and wherein the configurable dielectric pair separator is arranged within the jacket to form at least two grooves.

Designation	Claim 28
	28. The data communications cable as claimed in claim 27 , wherein the configurable dielectric pair separator is arranged to provide a sufficient spacing between the first twisted pair of insulated conductors and the second twisted pair of insulated conductors so as to provide a desired crosstalk isolation between the first twisted pair of insulated conductors and the second twisted pair of insulated conductors.

Designation	Claim 29
	29. The data communications cable as claimed in claim 27 , wherein at least two grooves do not form completely enclosed channels.

Designation	Claim 30
	30. The data communications cable as claimed in claim 27 , wherein the configurable dielectric pair separator comprises a foamed polymer tape.

Designation	Claim 31
Element 31.pre	31. A data communications cable comprising:
Element 31.a	a plurality of twisted pairs of insulated conductors,

Element 31.b	a configurable dielectric pair separator disposed between at least two of the plurality of twisted pairs of insulated conductors,
Element 31.c	the configurable dielectric pair separator including a substantially flat dielectric tape formed of a foamed polymer;
Element 31.d	a jacket enclosing the plurality of twisted pairs of insulated conductors and the configurable dielectric pair separator; and
Element 31.e	wherein the plurality of twisted pairs of insulated conductors and the configurable dielectric pair separator are twisted about a common axis to form a twisted pair cable.

Designation	Claim 32
	32. The data communications cable as claimed in claim 31 , wherein the configurable dielectric pair separator is arranged to provide a sufficient spacing between the at least two twisted pairs of insulated conductors so as to provide a desired crosstalk isolation between the at least two twisted pairs of insulated conductors.

Designation	Claim 33
	33. The data communications cable as claimed in claim 31 , wherein the configurable dielectric pair separator is arranged within the jacket to provide at least two grooves, at least one twisted pair of conductors being disposed within each of the at least two grooves.