

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMPHENOL CORP.,
Petitioner

v.

PPC BROADBAND, INC.,
Patent Owner

Case No. IPR2023-01363
Patent No. 9,008,483

**DECLARATION OF DR. SAYFE KIAEI
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 9,008,483**

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CLAIM LISTING

Claim 1:

Claim 1[Pre]: A drop interface box configured to be mounted to a structure and to receive a drop cable from an optical fiber service provider distribution point and a plurality of distribution cables which distribute the optical fiber service, the drop interface box comprising:

1(a) a base unit having a drop cable entrance configured to receive the drop cable and having drop cable retaining mechanisms spaced apart and configured to retain a length of drop cable looped around the drop cable retaining mechanisms;

1(b) a cover having a hinged connection to the base unit to selectively enclose a storage area provided in the base unit; and

1(c) a fiber storage panel having a hinged connection to the base unit on a side opposite the hinged connection of the cover to the base unit such that the fiber storage panel is moveable relative to the base unit and configured to be stored between the base unit and the cover,

1(d) the fiber storage panel having first spools positioned to store a plurality of feed break-out cables coupleable to the drop cable, the fiber storage panel further having second spools positioned to store a plurality of distribution cables coupleable to the plurality of feed break-out cables.

Claim 2:

The drop interface box of claim 1, wherein the fiber storage panel further includes an adapter bracket configured to hold one or more adapters which couple the plurality of feed break-out cables to the plurality of distribution cables.

Claim 10:

The drop interface box of claim 1, wherein the drop cable retaining mechanisms in the base unit comprise storage clips positioned on opposing sides of the base unit.

Claim 11:

The drop interface box of claim 1, wherein the drop cable entrance further comprises slots formed in the base unit and configured to receive a cable clip which clips over the drop cable, the slots and the cable clip forming a substantially weather tight seal with the base unit.

Claim 12:

The drop interface box of claim 11, and further comprising a strain-relief clamp coupled to the base unit proximate the drop cable entrance.

Claim 13:

The drop interface box of claim 1, and further comprising a security mechanism for securing the cover to the base unit in a closed position.

I, Sayfe Kiaei, declare as follows:

I. INTRODUCTION AND QUALIFICATIONS

1. I am over the age of 21 and am competent to make this declaration. I make this declaration based on facts and matters within my own knowledge and on information provided to me by others, and, if called as a witness, I could and would competently testify to the matters set forth herein.

A. Educational Background and Professional Experience

2. My qualifications are stated more fully in my curriculum vitae, which is attached as Exhibit A. Below is a summary of my education, work experience, and other qualifications.

3. I earned a Ph.D. in 1987 from Washington State University in Electrical, Computer, and Energy Engineering. From 1985 through 1987, while working toward my Ph.D., I worked with Boeing on the development of signal processing and control systems.

4. From 1987 through 1993, I was a tenured Professor at Oregon State University in the Electrical and Computer Engineering Department.

5. From 1993 to 2002, I was a Senior Member of Technical Staff with the Wireless Technology Center and Broadband Operations at Motorola Inc., where I was responsible for the development of wireless system, cellular system, RF integrated circuits, GPS, and Digital Subscriber Lines (DSL) transceivers. At

Motorola, I worked on the development of broadband transceivers for MODEMS including DSL, SDSL, VDSL, and Optical communication systems. I also conducted research, published papers, and supervised graduate students working on broadband communication transceivers.

6. Since 2001 I have held the position of Motorola Endowed Chair Professor in Analog and Radio Frequency Integrated Circuitry at the School of Electrical, Computer, and Energy Engineering at Arizona State University in Tempe, Arizona. I am also the Director of the National Science Foundation Center, Connection One. Connection One is an industry/university cooperative research center with focus on communication systems. The center has over thirty industrial members and five university members focused on developing communication systems, sensors, electronics, bio-electronics, and networking technologies.

7. At Arizona State University, I have developed and taught courses on Communications, Broadband Wirelines and Wireless Transceivers, Electronics, VLSI, Analog IC design, RFIC, communications, and related areas. In my over thirty years of academic experience, I have taught university courses and done research in electronics, RF and wireless system, bio-electronics, networking, communication systems, and sensors. I have graduated over 100 M.S. and Ph.D. students working under my supervision on their thesis, and many of them are professors in academia, or have senior positions in the industry. Currently, I have 8 M.S., Ph.D., and postdoc

students working with me in my lab on research related to communication and networking systems, wireless systems, RF, and integrated circuits. My research is funded by various sources, including industry, federal agencies including NSF, DARPA, ONR, DOE, and other, with an average total research funding of \$1M per year.

8. I have published over two hundred journal and conference papers covering topics such as wireless systems, power management, low-power electronics, sensors, radio frequency, integrated circuits (IC), filter design, and related areas. A list of my publications can be found in my CV, attached as Exhibit A. I also have over 10 patents and patent applications in electronics, RF, and low-power bio-electronics.

9. I am an IEEE Fellow, a distinction and the highest level of IEEE membership awarded by the IEEE directors to recognize a high level of demonstrated extraordinary accomplishments. The IEEE is the Institute of Electrical and Electronics Engineers, the world's largest association of technical professionals whose objectives include the educational and technical advancement of electrical and electronic engineering, telecommunications, computer engineering, and related disciplines. I am a member of the IEEE Circuits and Systems Society, IEEE Solid State Circuits Society, and IEEE Communication Society, IEEE RF and Microwave committees, IEEE International Symposium on Low Power Electronics and Design

(ISLPED), IEEE Signal Processing Society, IEEE Fellow Selection Committee, and many other International Electrical Engineering societies. I was one of the key organizers to establish the IEEE Radio Frequency Integrated Circuits (RFIC) symposium in 1995, and IEEE International Symposium on Low Power Electronics and Design (ISLPED) in 1997. I have been on the executive committee, and technical committee of RFIC and ISLPED for the last 16 years. The RFIC and ISLPED Symposia have grown and is now the premier international symposium in the world where the latest RF, low-power electronics, wireless, and bio-electronic circuits and components are presented.

10. I have received several awards including the Carter Best Teacher Award, the IEEE Darlington Award (which is given for the best technical paper on circuits and systems in the IEEE Circuits and Systems Society), and the Motorola 10X Rapid Design Cycle Reduction Award.

11. I have been one of the key organizers of the IEEE International Symposium on Low Power Electronics and Design (ISLPED) since 1997. I have published papers and organized sessions on techniques for low-power cellular phones at ISLPED. I have published a number of papers on the design and development of low-power RF, wireless transceivers, sensors, and low-power bioelectronics.

12. I have also been a consultant on various projects with Intel (designing 2G, 3G mobile telephone transceivers, Internet-of-Things (IOT), and sensors), Texas Instrument (developing 3G cellular and Bluetooth technologies), Sony Wireless (developing GPS technologies), Tektronics (designing wireless systems), and various other consultancies. During my work in industry, I have designed and contributed to the design of many wireless systems for commercial products. Many of my designs are still in use today in products manufactured by the companies I have worked for, including Motorola, Intel, Sony, and more.

13. I am being compensated for my time at my ordinary hourly rate of \$475. My compensation is not dependent on the outcome of these proceedings or the content of my opinions. To the best of my knowledge, I have no financial interest in either party or in the outcome of this proceeding.

II. METHODOLOGY; MATERIALS CONSIDERED

14. I have relied upon my education, knowledge and experience with the technology of communication networks, as well as the other materials as discussed in this declaration in forming my opinions.

15. For this work, I have been asked to review U.S. Patent No. 9,008,483 (“’483 Patent”) (Ex. 1001) including the specification and claims, and the ’483 Patent’s prosecution history (“’483 File History”) (Ex. 1002). In developing my

opinions relating to the '483 Patent, I have considered the materials cited or discussed herein, including those listed below.

- U.S. Patent No. 9,008,483 (“’483 Patent”) (Ex. 1001)
- Prosecution History for the '483 Patent (“’483 FH”) (Ex. 1002)
- U.S. Patent Application Publication No. 2009/0202214 to Holmberg et al. (“*Holmberg*”) (Ex. 1004)
- U.S. Patent Application Publication No. 2008/0112681 to Battey et al. (“*Battey*”) (Ex. 1005)
- U.S. Patent No. 6,721,484 to Blankenship et al. (“*Blankenship*”) (Ex. 1006)
- U.S. Patent No. 8,965,168 to Cowen et al. (“*Cowen*”) (Ex. 1007)
- U.S. Patent No. 7,346,253 to Bloodworth et al. (“*Bloodworth*”) (Ex. 1008)
- U.S. Patent No. 7,539,388 to Mertesdorf et al. (“*Mertesdorf*”) (Ex. 1009)
- U.S. Patent Application Publication No. 2005/0276562 to Battey et al. (“*Battey* ’562”) (Ex. 1010)
- U.S. Patent No. 8,121,458 to Barth et al. (“*Barth*”) (Ex. 1011)
- U.S. Patent No. 8,009,954 to Bran de Leon et al. (“*Bran de Leon*”) (Ex. 1012)
- U.S. Patent No. 4,792,203 to Nelson et al. (“*Nelson*”) (Ex. 1013)
- International Publication No. WO 2010/040256 to Castonguay et al. (“*Castonguay*”) (Ex. 1014)
- U.S. Patent No. 7,088,893 to Cooke et al. (“*Cooke*”) (Ex. 1015)

16. I have considered these materials from the viewpoint of a POSITA as of the priority date of the '483 Patent. For the purposes of this declaration, I have been asked to assume that the priority date of the '483 Patent is April 5, 2011. I note that my opinions provided in this declaration are made from the perspective of a POSITA as of this priority date of the '483 Patent, unless expressly stated otherwise. To the extent that I use any verb tense in this declaration that is present tense (e.g.,

“a POSITA would understand” instead of “a POSITA would have understood”), such verb tense should be understood to be my opinion as of the ’483 Patent’s priority date (again, unless expressly stated otherwise). I merely use the present verb tense for ease of reading.

III. OVERVIEW AND LEGAL STANDARDS

17. In formulating my opinions, I have been instructed to apply certain legal standards. I am not a lawyer. I do not expect to offer any testimony regarding what the law is. Instead, the following sections summarize the law as I have been instructed to apply it in formulating and rendering my opinions found later in this declaration. I understand that, in an *inter partes* review (“IPR”) proceeding, patent claims may be deemed unpatentable if it is shown that they were anticipated or rendered obvious in view of the prior art. I understand that prior art in an IPR review is limited to patents or printed publications that predate the priority date of the patent at issue. I understand that questions of claim clarity (definiteness) and enablement cannot be considered as a ground for considering the patentability of a claim in these proceedings.

A. Person of Ordinary Skill in the Art

18. I understand that the ’483 Patent, the record of proceedings at the Patent Office (which I understand is called the “File History” or “Prosecution History”), and the teachings of the prior art are evaluated from the perspective of a person of

ordinary skill in the art (“POSITA”). I understand that the factors considered in determining the ordinary level of skill in the art include: (i) the levels of education and experience of persons working in the field; (ii) the types of problems encountered in the field; and (iii) the sophistication of the technology. I may also consider, if available, the education level of the inventor, prior art solutions to the problems encountered in the art, and the rapidity with which innovations are made in the relevant art.

19. I understand that a person of ordinary skill in the art is not a specific real individual, but rather a hypothetical individual having the qualities reflected by the factors above. This hypothetical person has knowledge of all prior art in the relevant field as if it were arranged on a workshop wall and takes from each reference what it would teach to a person having the skills of a POSITA.

B. Obviousness

20. I understand that a claim may be invalid under 35 U.S.C. § 103(a) if the subject matter described by the claim as a whole would have been “obvious” to a hypothetical POSITA in view of a single prior art reference or in view of a combination of references at the time the claimed invention was made. Therefore, I understand that obviousness is determined from the perspective of a hypothetical POSITA. I further understand that a hypothetical POSITA is assumed to know and to have all relevant prior art in the field of endeavor covered by the patent in suit and

all analogous prior art. I understand that obviousness in an IPR review proceeding is evaluated using a preponderance of the evidence standard, which means that the claims must be more likely obvious than nonobvious.

21. I also understand that an analysis of whether a claimed invention would have been obvious should be considered in light of the scope and content of the prior art, the differences (if any) between the prior art and the claimed invention, and the level of ordinary skill in the pertinent art involved. I understand as well that a prior art reference should be viewed as a whole. I understand that in considering whether an invention for a claimed combination would have been obvious, I may assess whether there are apparent reasons to combine known elements in the prior art in the manner claimed in view of interrelated teachings of multiple prior art references, the effects of demands known to the design community or present in the marketplace, and/or the background knowledge possessed by a POSITA. I also understand that other principles may be relied on in evaluating whether a claimed invention would have been obvious, and that these principles include the following:

- A combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results;
- When a device or technology is available in one field of endeavor, design incentives and other market forces can prompt variations of it,

either in the same field or in a different one, so that if a POSITA can implement a predictable variation, the variation is likely obvious;

- If a technique has been used to improve one device, and a POSITA would have recognized that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill;
- An explicit or implicit teaching, suggestion, or motivation to combine two prior art references to form the claimed combination may demonstrate obviousness, but proof of obviousness does not depend on or require showing a teaching, suggestion, or motivation to combine;
- Market demand, rather than scientific literature, can drive design trends and may show obviousness;
- In determining whether the subject matter of a patent claim would have been obvious, neither the particular motivation nor the avowed purpose of the named inventor controls;
- One of the ways in which a patent's subject can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims;

- Any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed;
- “Common sense” teaches that familiar items may have obvious uses beyond their primary purposes, and in many cases a POSITA will be able to fit the teachings of multiple patents together like pieces of a puzzle;
- A POSITA is also a person of ordinary creativity, and is not an automaton;
- A patent claim can be proved obvious by showing that the claimed combination of elements was “obvious to try,” particularly when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions such that a POSITA would have had good reason to pursue the known options within his or her technical grasp; and
- One should not use hindsight in evaluating whether a claimed invention would have been obvious.

22. I also understand that an obviousness determination includes the consideration of various factors such as: (1) the scope and content of the prior art, (2) the differences between the prior art and the asserted claims, (3) the level of

ordinary skill in the pertinent art, and (4) the existence of secondary considerations such as commercial success, long-felt but unresolved needs, failure of others, and so forth.

23. I am informed that it is improper to combine references where the references teach away from their combination. I am informed that a reference may be said to teach away when a person of ordinary skill in the relevant art, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the patent applicant. In general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the patentee. I am informed that a reference teaches away, for example, if (1) the combination would produce a seemingly inoperative device, or (2) the references leave the impression that the product would not have the property sought by the patentee. I also am informed, however, that a reference does not teach away if it merely expresses a general preference for an alternative invention but does not criticize, discredit, or otherwise discourage investigation into the invention claimed.

24. I am informed that even if a *prima facie* case of obviousness is established, the final determination of obviousness must also consider "secondary considerations" if presented. In most instances, the patentee raises these secondary

considerations of non-obviousness. In that context, the patentee argues an invention would not have been obvious in view of these considerations, which include: (a) commercial success of a product due to the merits of the claimed invention; (b) a long-felt, but unsatisfied need for the invention; (c) failure of others to find the solution provided by the claimed invention; (d) deliberate copying of the invention by others; (e) unexpected results achieved by the invention; (f) praise of the invention by others skilled in the art; (g) lack of independent simultaneous invention within a comparatively short space of time; and (h) teaching away from the invention in the prior art.

25. I am further informed that secondary considerations evidence is only relevant if the offering party establishes a connection, or nexus, between the evidence and the claimed invention. The nexus cannot be based on prior art features. The establishment of a nexus is a question of fact. While I understand that Patent Owner here has not offered any secondary considerations at this time, I will supplement my opinions in the event that Patent Owner raises secondary considerations during the course of this proceeding.

C. Analogous Art

26. I have been informed that for a prior art reference to be proper for use in an obviousness analysis, the reference must be “analogous art” to the claimed invention. I have been informed that a reference is analogous art to the claimed

invention if: (1) the reference is from the same field of endeavor as the claimed invention (even if it addresses a different problem); or (2) the reference is reasonably pertinent to the problem faced by the inventor (even if it is not in the same field of endeavor as the claimed invention). In order for a reference to be “reasonably pertinent” to the problem, it must logically have commended itself to an inventor’s attention in considering his problem. In determining whether a reference is reasonably pertinent, one should consider the problem faced by the inventor, as reflected either explicitly or implicitly, in the specification. I believe that all of the references that my opinions in this IPR are based upon are well within the range of references a person having ordinary skill in the art would consult to address the type of problems described in the Challenged Claims.

D. Claim Construction

27. I understand that the claim terms in this IPR will be construed according to their plain and ordinary meaning as understood in light of the claim language, the patent’s description, and the prosecution history viewed from the perspective of a POSITA. I further understand that where a patent defines claim language, the definition in the patent controls, even if there are other definitions that might be understood by those working in the art.

28. I understand the Petition presents two alternative interpretations of the claimed “drop cable,” summarized as follows:

Separate obviousness grounds are presented (1) to capture a ***first construction***, which requires the drop cable retain its external jacket as it is routed internally, and (2) to capture a broader ***second construction***, consistent with Patent Owner's infringement allegations, which allows the external jacket to be removed as the drop cable enters the DIB and the fibers routed inside the box without the external jacket.

Petition, 9-16. I have been asked to apply these alternative constructions in my opinions below, and I take no position as to which is correct. For all other claim language, I have applied the plain and ordinary meaning as defined in the preceding paragraph.

IV. LEVEL OF A PERSON OF ORDINARY SKILL

29. Based on my review and analysis of the '483 Patent, the prior art cited herein, and the ordinary skill factors described in this section, a POSITA in the field of the '483 Patent at the time of the earliest possible priority date (April 5, 2011) would have been knowledgeable regarding the field of communication networks. In my experience working in this field, most workers of ordinary skill in the art as of the earliest possible priority date of April 5, 2011, would have had a bachelor's degree in electrical engineering, computer engineering, or a related field, and at least one year of experience related to communication networks or the equivalent. *See, e.g., '483 Patent* (Ex. 1001), 1:16-27, 2:3-15, 3:6-16 (describing embodiments of '483 Patent). A person with less relevant practical experience but with additional

education can also qualify as a POSITA in the field of the '483 Patent. When I refer to the understanding of a POSITA, I am referring to the understanding of such a person as of April 5, 2011.

30. As of April 5, 2011, I had more than ordinary skill in the art. I am, however, familiar with the skills and knowledge possessed by those I would have considered to be of ordinary skill in the art as of that date. For example, I worked on the development of single chip IC for DSL and optical communication at Motorola from 1993-1997. I also represented Motorola at ITU, ETSI, and other international standards working on broadband communication access. I also worked on enclosures for reducing coupling, noise interference, and environmental issues (such as moisture, thermal, physical damages and related areas) for broadband communications and developing enclosures.

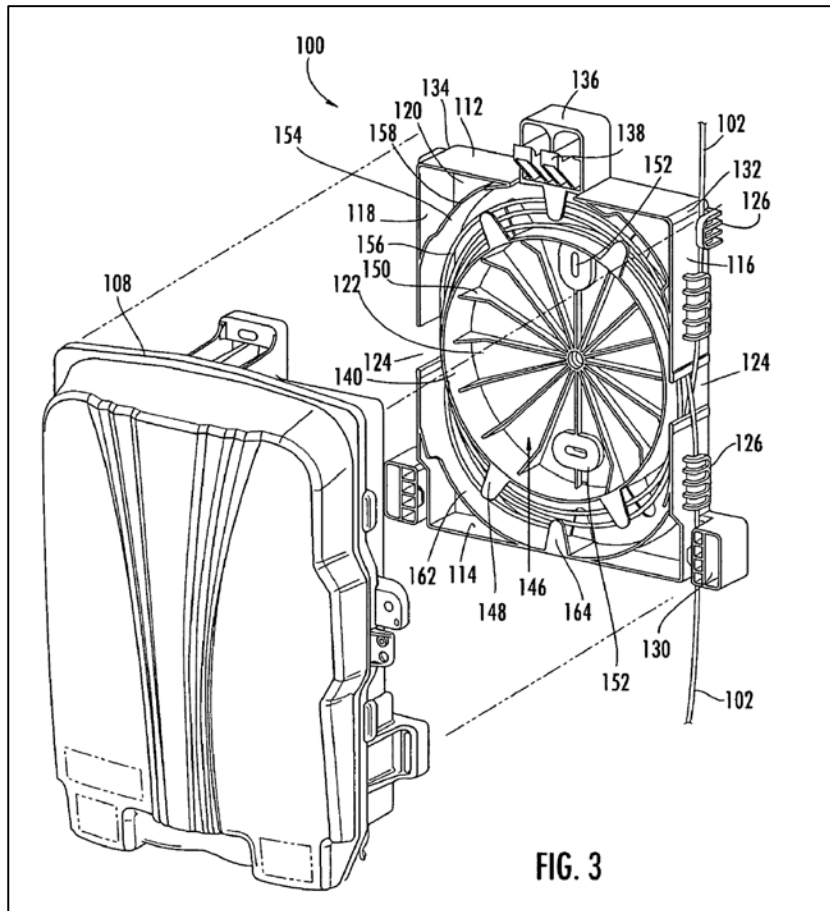
31. My opinions provided in this declaration would not change in view of minor modifications to this level of ordinary skill.

V. OVERVIEW OF THE TECHNOLOGY

32. The features described and claimed in the '483 Patent were routine as of April 5, 2011. In the following paragraphs, I briefly summarize the technology background for a few key features relevant to the opinions set forth herein.

A. Fiber Optic Cable Enclosures

33. Enclosures for storing cables for communication systems (including storing fiber optic cable) were well known in the art before the priority date of the '483 Patent. For example, *Bloodworth* (Ex. 1008) teaches “a fiber optic drop cable storage receptacle for storing and protecting the excess length of a pre-connectorized fiber optic drop cable deployed between a connection terminal and a subscriber network interface device (NID) in an optical communications network.” *Bloodworth*, 2:20-26. In particular, *Bloodworth* teaches facilitating “the deployment of optical fiber to the subscriber premises” with the slack storage receptacle by “storing the excess length of fiber optic drop cable that extends between a network connection terminal and the subscriber premises.” *Bloodworth*, 2:35-39. *Bloodworth* further teaches mounting said receptacle. *Bloodworth*, 2:39-43, 7:39-41. *Bloodworth*'s Fig. 3 below depicts a fiber optic drop cable slack storage receptacle. *Bloodworth*, 6:25-29.



Bloodworth, Fig. 3.

34. *Bloodworth* teaches protecting fiber optic cable by not violating the minimum bend radius. *Bloodworth*, 8:4-12. Preventing the minimum bend radius from being violated is desirable because “bending a fiber optic cable to less than its minimum bend radius may damage the optical fibers and/or impair the optical transmission characteristics of the cable.” *Id.*

35. It was also known to seal or otherwise provide weather resistance to enclosures to keep out moisture, dust, rain, or other potentially damaging substances. For example, *Bloodworth* teaches protecting “against adverse environmental

conditions during shipping and deployment” by utilizing gaskets and fasteners.

Bloodworth, 17:32-38.

36. Similarly, *Mertesdorf* teaches a cable entry fitting that is a “compression fitting configured to fit closely” about a cable to “seal against entry water or other contaminants through base 432 when cover 434 is in place.”

Mertesdorf (Ex. 1009), 12:41-44.

37. In another example, *Battey '562* teaches a sealing feature between a base and cover of a fiber optic enclosure to prevent water intrusion. *Battey '562* (Ex. 1010), [0025].

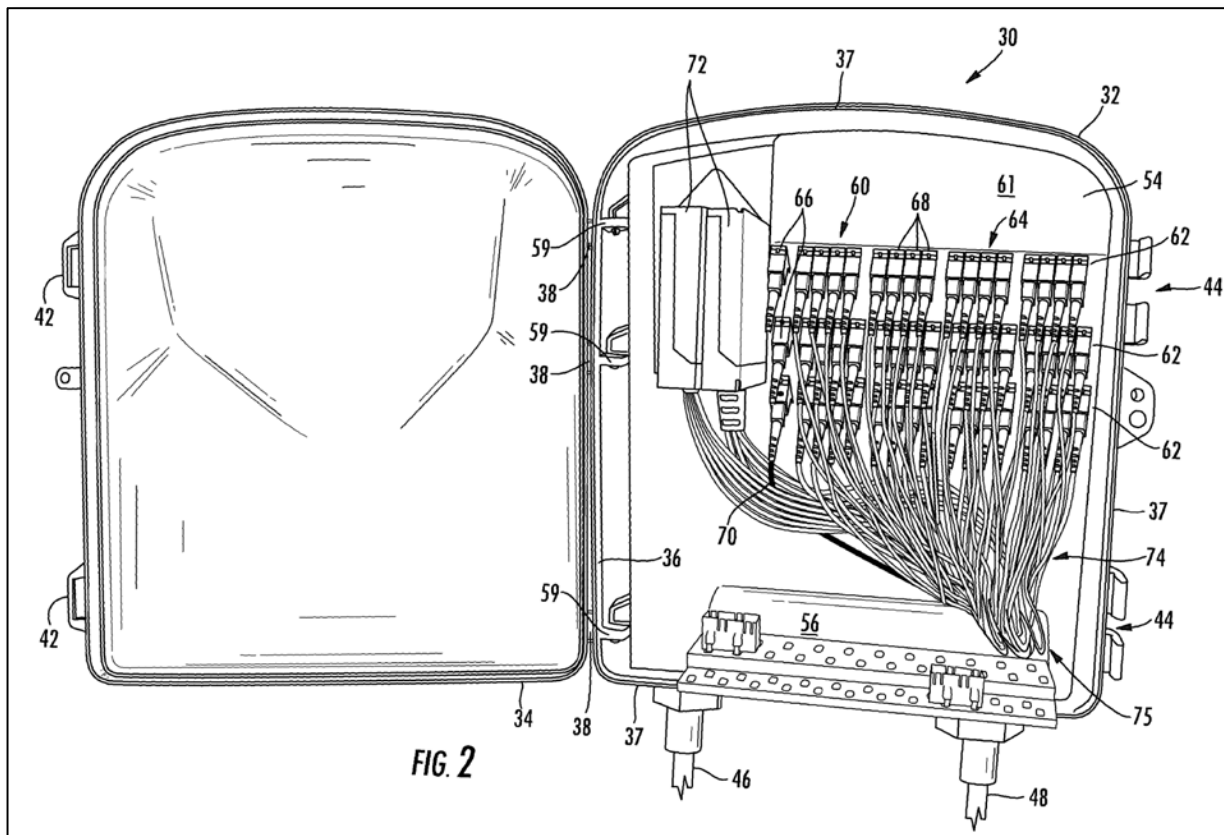
B. Fiber Optic Cable Storage Trays

38. It was known to use trays, such as splice trays, for storing fiber optic cable before the priority date of the '483 Patent. For example, *Bran de Leon* teaches a fiber optic splice tray for splicing together two or more optical fibers. For example, *Bran de Leon* teaches a “distribution cable network often includes a main or trunk cable including a plurality of fibers, and a plurality of branch cables (e.g., drop cables) that are spliced to corresponding fibers of the trunk cable and that are routed to locations such as subscriber locations or drop terminals.” *Bran de Leon* (Ex. 1012), 1:34-39. Further, *Bran de Leon* teaches that splice trays “can be used to protect and manage the region of the distribution cable where the branch cable or cables are spliced to the trunk cable.” *Bran de Leon*, 1:39-41, 4:53-60.

39. It was also known to use a hinged connection for a splice tray or fiber storage panel before the priority date of the '483 Patent. For example, *Castonguay* teaches an embodiment wherein a hinged connection for a transition panel, where the hinged connections 59 are located on the opposite side of the base as the hinge connections 38 between the cover and the base.

Although the transition panel 54 is illustrated in the stowed position in FIG. 2, the transition panel 54 is rotatable relative to the base 32 through an angle of approximately one hundred and ten (110) degrees between the stowed position and the deployed position, although any degree of rotation can be provided. The transition panel 54 is generally rectangular and is hingedly affixed to the base 32 along the upper edge of the side wall 36 at one or more hinge locations 59 as shown in FIG. 2. The hinge locations 59 are located on the same side wall 36 as the one or more hinge locations 38 that hingedly affix the cover 34 to the base 32 in this embodiment. However, the hinge locations 59 may be located on the opposite side wall 36 as the hinge locations 38.

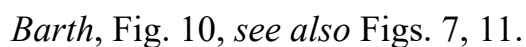
Castonguay (Ex. 1014), [0026].



Castonguay, Fig. 2.

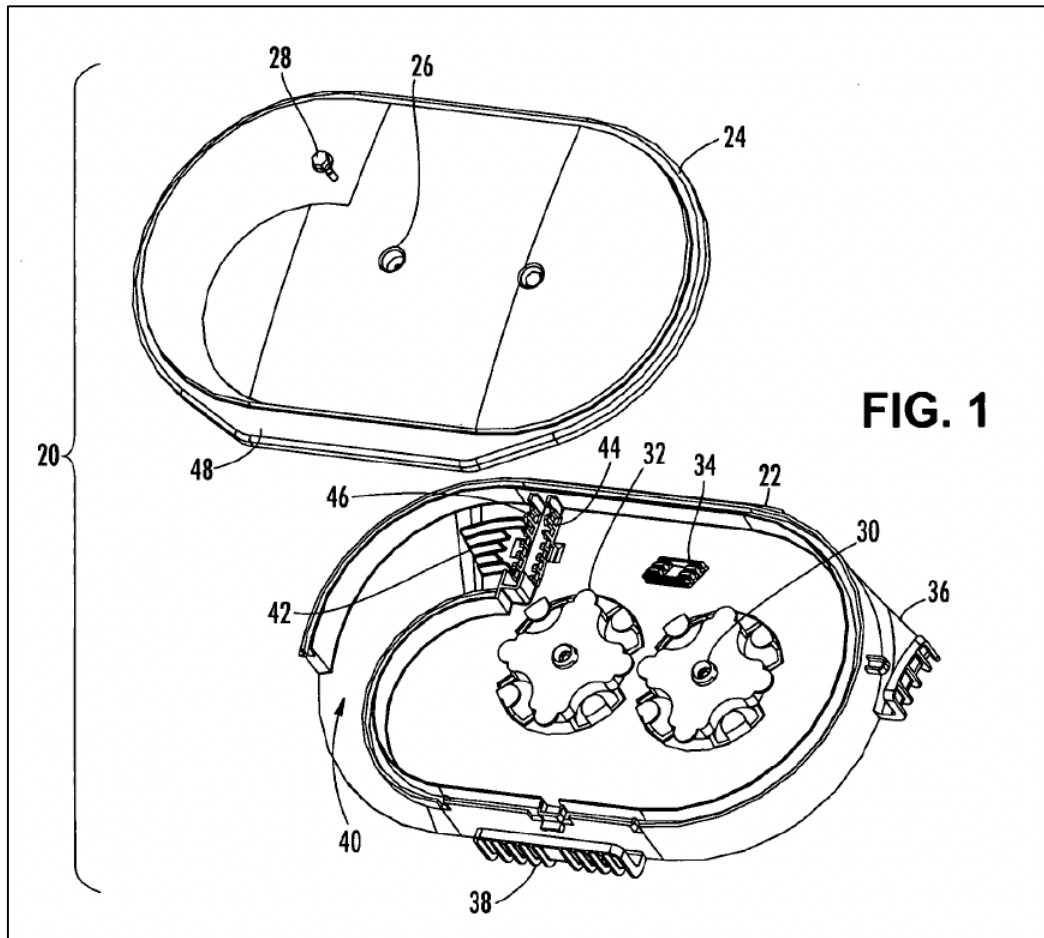
C. Cable Slack Storage

40. It was also known before the priority date of the '483 Patent to store excess cable slack on spools. For example, *Barth* teaches storing excess feed cable on partial spools 952 and 954. *Barth* (Ex. 1011), 8:31-54.

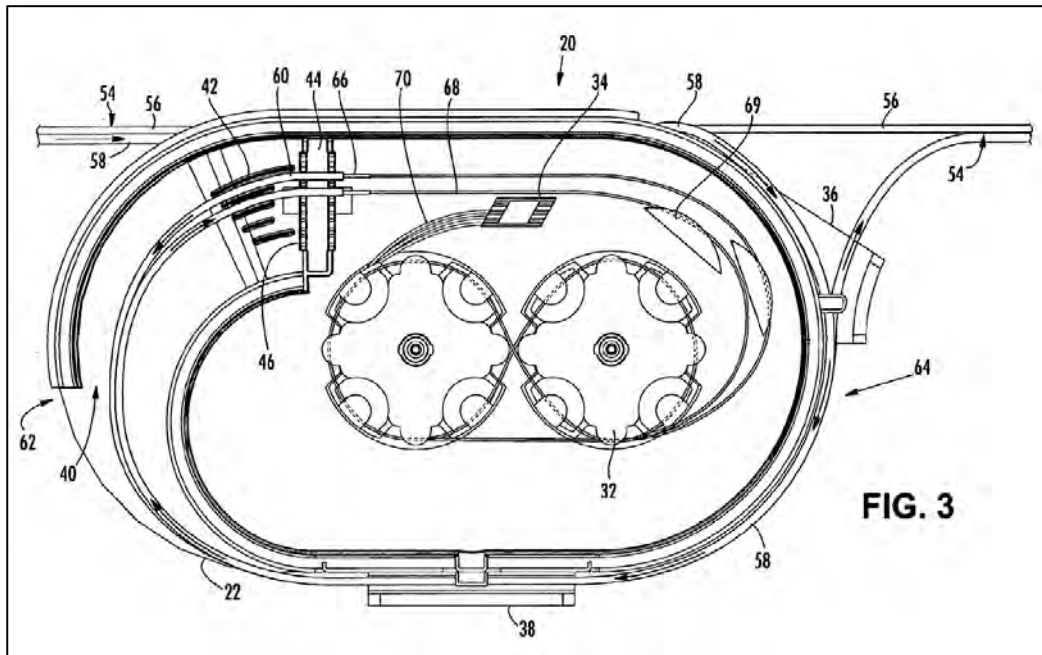


41. In another example, *Battey* '562 teaches storing excess cable slack on spools 32. *Battey* '562, [0023] (“[T]wo routing spools 32 are used to manage and store optical fiber slack by wrapping the optical fibers around the spools 32, for example in a figure-eight pattern[.]”), *id.* (“The routing spools 32 also allow the

optical fibers of a distribution cable and one or more drop cables to be routed into and out of the closure 20 without violating the minimum bend radius of the fibers, while storing as much slack as needed.”), [0028], [0031]. Fig. 1 below depicts spools 32.

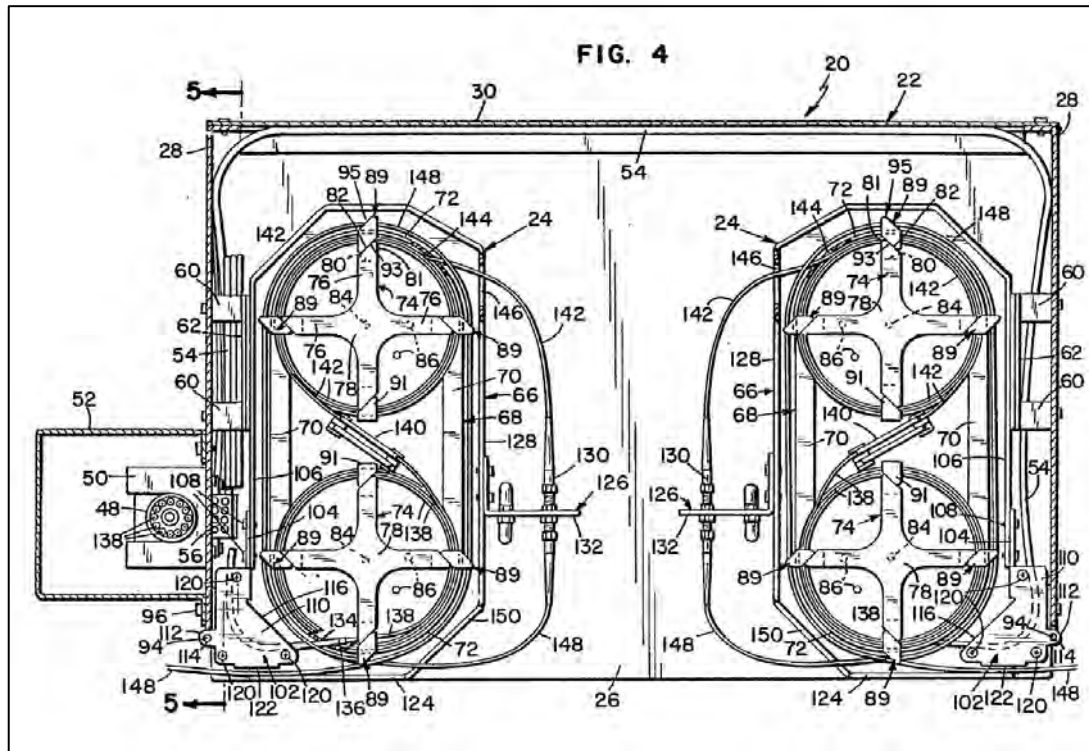


Batley '562, Fig. 1. Fig. 3 below also depicts spools 32:



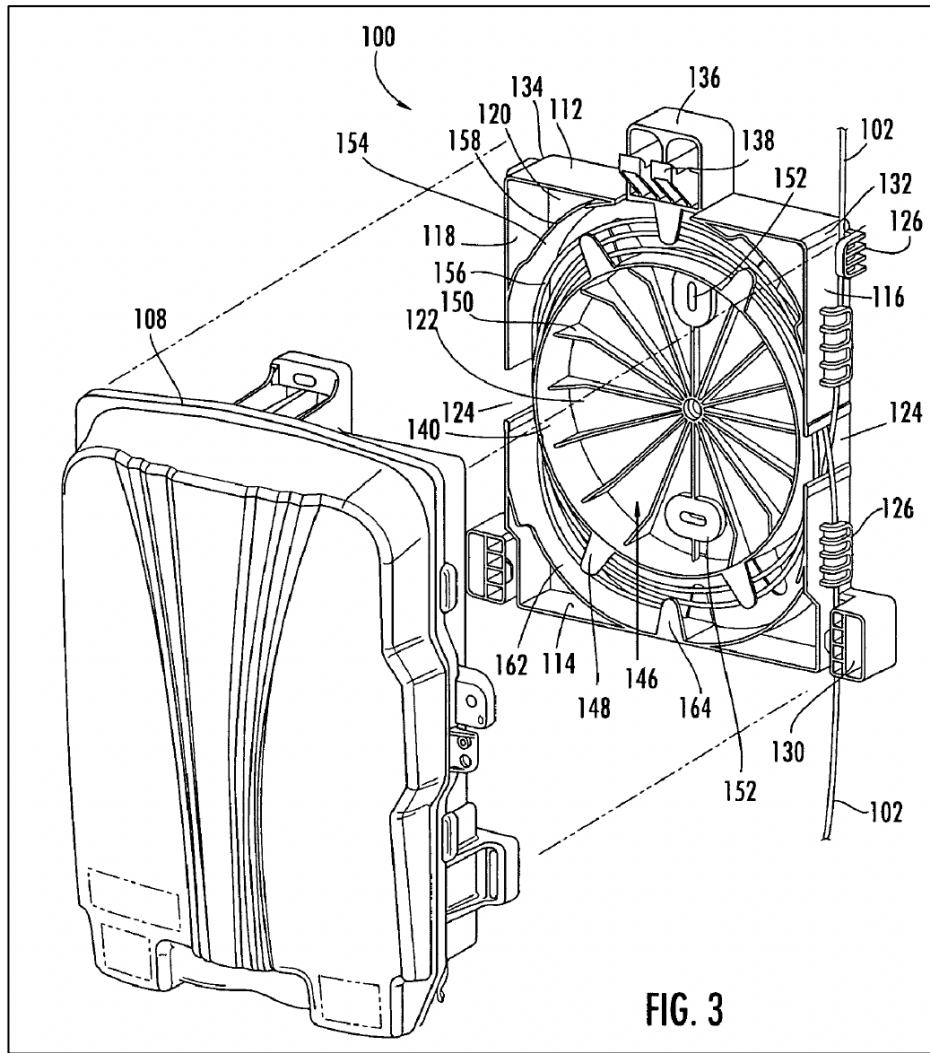
Batley '562, Fig. 3.

42. In another example, *Nelson* teaches using trays that include “a spool for storing any excess or slack portion of the pigtail fiber and a second spool for storing any excess or slack portion of the trunk cable fiber.” *Nelson* (Ex. 1013), 2:1-13, 2:41-52, 5:58-60, 7:29-8:6. *Nelson*’s spools 74 are depicted in Fig. 4 below:



Nelson at Fig. 4.

43. In another example, *Bloodworth* teaches storing a length of excess drop cable in an enclosure. For example, *Bloodworth* teaches “a fiber optic drop cable storage receptacle for storing and protecting the excess length of a pre-connectorized fiber optic drop cable deployed between a connection terminal and a subscriber network interface device (NID) in an optical communications network.” *Bloodworth*, 2:20-26. Further, *Bloodworth* teaches the NID is “configured to store fiber optic drop cable slack while maintaining the minimum bend radius of the drop cable.” *Bloodworth*, 2:45-50, 6:25-29, 8:4-12. *Bloodworth*’s Fig. 3 below depicts NID 100 and drop cable 102 slack storage:



Bloodworth, Fig. 3.

D. Pre-Connectorized Cables and Mid-Span Access

44. It was also known before the priority date of the '483 Patent that pre-connectorized fiber optic cables were compatible with enclosures used in a mid-span access configuration as well as for terminating access. For example, *Cooke* teaches a pre-connectorized fiber optic distribution cable that includes at least one “mid-span access location” along the length of said cable. *Cooke* (Ex. 1015), 5:42-47. *Cooke*

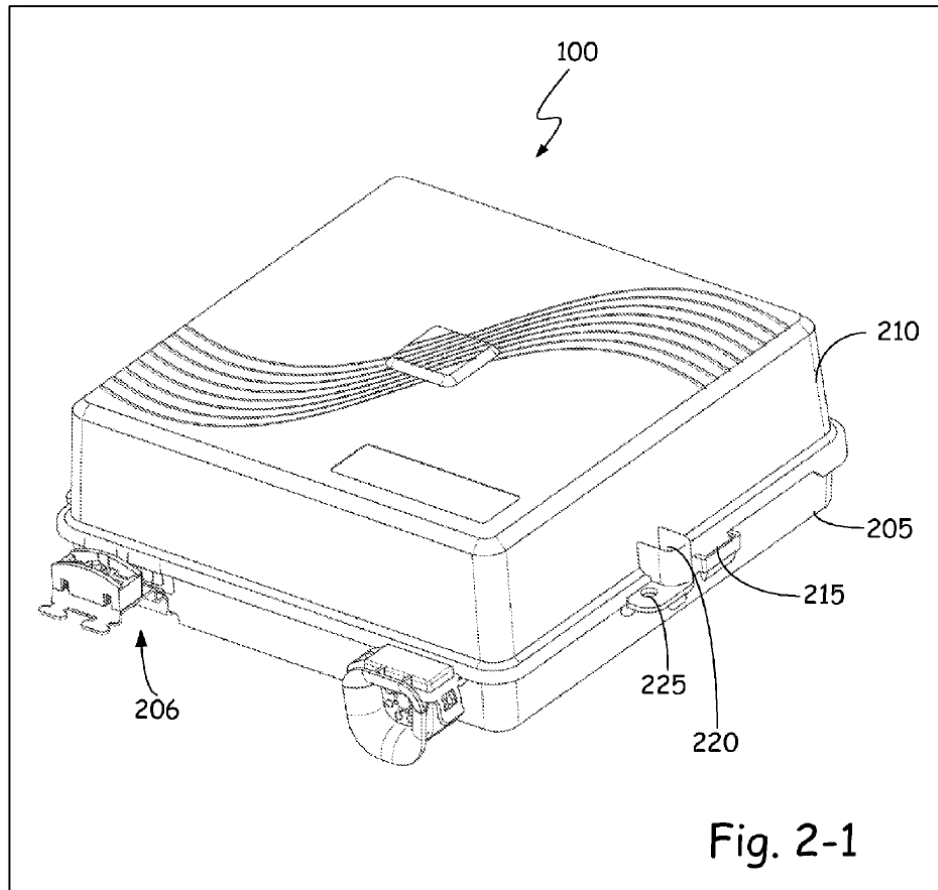
teaches a “pre-connectorized fiber optic distribution cable and, more particularly” “a factory-assembled fiber optic distribution cable having at least one predetermined mid-span access location for providing access to a plurality of optical fibers that are preterminated and pre-connectorized to a multifiber connector.” *Cooke*, 1:16-22. *Cooke* teaches that “[e]ach mid-span access location provides access to a plurality of preterminated and pre-connectorized optical fibers for interconnecting at least one drop cable to the distribution cable.” *Cooke*, 2:60-63. Further, *Cooke* teaches that the “pre-connectorized fiber optic distribution cable is configured for ease of installation[.]” *Cooke*, 2:56-57.

45. *Cooke* teaches utilizing an enclosure to provide cover and protection at drop cable connection points. *Cooke*, 5:63-67 (“Once the cable system is installed, a portion of a protective covering is removed to expose at least one optical connector, and any conventional enclosure may be added to the system in order to provide protection and drop cable connection points.”), 12:32-35, 2:37-42 (“...configured with a variety of different closures in the field as needed.”). Indeed, *Cooke* teaches using a “conventional network connection terminal 42, such as but not limited to, a local convergence cabinet (LCC), a pedestal, a network access point (NAP) or a network interface device (NID)” and that the “connectorized drop cables may then be routed from the connection terminal 42 to one or more subscriber premises.” *Cooke*, 6:49-7:12, 7:33-38, Fig. 1.

VI. OVERVIEW OF THE '483 PATENT

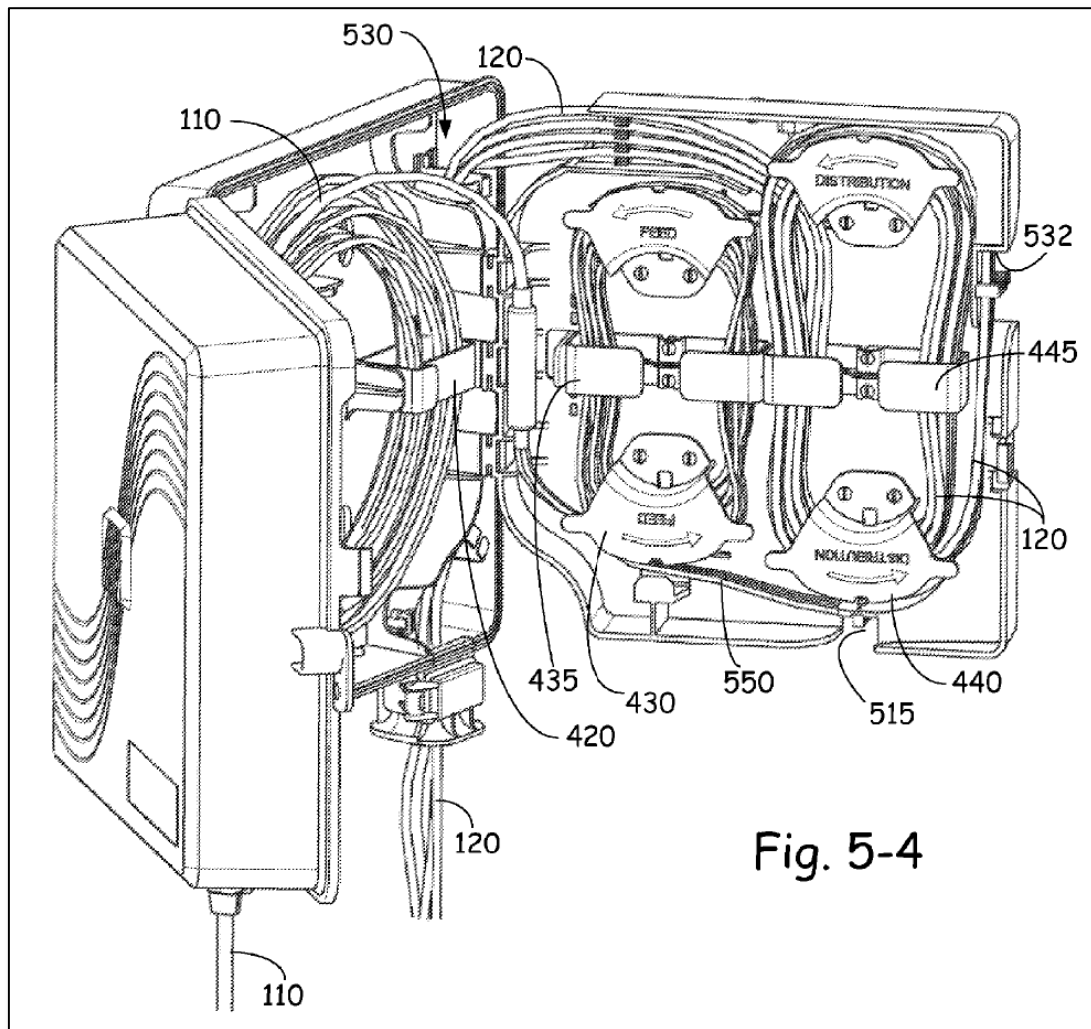
46. I have reviewed the '483 Patent (Ex. 1001). Descriptions of the '483 Patent that may be pertinent to my analysis are provided below. This discussion does not represent my entire understanding of the '483 Patent.

47. The '483 Patent describes a drop interface box that is configured to be mounted to a structure. *'483 Patent*, 3:19-22. Further, the '483 Patent describes the drop interface box includes a base unit that has a drop cable entrance for receiving a drop cable. *'483 Patent*, 3:58-61. The drop interface box is described as including drop cable storage clips and a cover with a hinged connection to the base unit. *'483 Patent*, 4:49-62.



'483 Patent, Fig. 2-1.

48. Further, the '483 Patent describes a fiber storage panel that has a hinged connection to the base unit on a side opposite of a hinged connection between the base unit and the cover. '483 Patent, 4:49-53. Additionally, the '483 Patent describes the fiber storage panel includes spools for storing a plurality of feed break-out cables and spools that store a plurality of distribution cables. '483 Patent, 4:58-5:2, 5:30-40.



'483 Patent, Fig. 5-4.

VII. THE PROSECUTION HISTORY OF THE '483 PATENT

49. I have reviewed the prosecution history for the '483 Patent (Ex. 1002).

Pertinent aspects of the prosecution history of the '483 Patent are described below.

A. Prosecution History of the '483 Patent

50. The '483 Patent issued on April 14, 2015 from an application that was filed April 5, 2012. '483 *Patent*, (22), (45). I note that the '483 Patent claims priority to a provisional application that was filed April 5, 2011. '483 *Patent*, (60).

51. During prosecution of the application that issued as the '483 Patent, the Examiner issued a non-final office action that rejected the original claims 1-4 and 11-14 as being unpatentable under pre-AIA 35 U.S.C. § 103(a) over *Holmberg*. '483 *FH* (Ex. 1002), 232. The Applicant amended original Claim 1 to include the limitation of the fiber storage panel “having a hinged connection to the base unit on a side opposite the hinged connection of the cover to the base unit such that the fiber storage panel is” moveable relative to the base unit. '483 *FH*, 247. The Applicant also argued that *Holmberg* taught away from using a hinged connection between a splice tray and a base unit. '483 *FH*, 253-256. Subsequently, a Notice of Allowance issued on December 15, 2014. '483 *FH*, 280.

VIII. SUMMARY OF UNPATENTABILITY

Proposed Grounds of Unpatentability	
<u>Ground 1</u>	Claims 1 and 11 are obvious under pre-AIA 35 U.S.C. § 103(a) over <i>Holmberg</i> in view of <i>Battey</i>
<u>Ground 2</u>	Claims 2, 12-13 are obvious under pre-AIA 35 U.S.C. § 103(a) over <i>Holmberg</i> in view of <i>Battey</i> and <i>Blankenship</i>
<u>Ground 3</u>	Claims 1-2, 11-13 are obvious under pre-AIA 35 U.S.C. § 103(a) over <i>Holmberg</i> in view of <i>Battey</i> and <i>Blankenship</i>
<u>Grounds 4-5</u>	Claim 10 is obvious under pre-AIA 35 U.S.C. § 103(a) over <i>Holmberg</i> in view of <i>Battey</i> and <i>Cowen</i> or <i>Holmberg</i> in view of <i>Battey</i> , <i>Blankenship</i> and <i>Cowen</i>

52. Above, I have reproduced the Proposed Grounds of Unpatentability from the Petition for ease of reference.

53. As I opine below, *Holmberg* teaches a wall box that is configured to be mounted to a structure. *Holmberg* further teaches a main body 216 (“base unit”) and a drop cable, where main body 216 receives the drop cable. I note *Holmberg* teaches the “second construction” of drop cable. *See* Grounds 1, 2. Namely, *Holmberg*’s wall box does not route a drop cable that retains its external jacket inside the box. Instead, *Holmberg* routes internal fiber components inside its box without an external jacket. *Holmberg* also teaches a plurality of first and second spools, as claimed. Further, *Holmberg* teaches drop cable retaining mechanisms, a cover, and a splice tray (“fiber storage panel”). *Battey* teaches an optical connection closure that includes a base, a cover, and a shelf and wherein the shelf is hingedly affixed to the base on the opposite side where the cover is hingedly fixed to the base.

54. I note that *Blankenship* teaches the “first construction” of drop cable.

See Ground 3, which combines *Holmberg*, *Battey*, and *Blankenship*.

IX. OVERVIEW OF THE PRIOR ART

A. Overview of Holmberg

55. *Holmberg* (Ex. 1004) teaches a wall box 200 that stores fiber optic cables and that is configured to be mounted to a wall or pole. *Holmberg*, [0003]-[0004], [0010]-[0011], [0034]-[0035], [0051]-[0053], Figs. 1-2, 6. Further, *Holmberg*’s wall box is configured for indoor or outdoor applications. *Id.* *Holmberg* teaches a cover and a main body of wall box 200 and that wall box 200 includes a hinged connection between the cover and main body. *Holmberg*, [0038]-[0039], Figs. 4, 10. Additionally, *Holmberg* teaches utilizing spools to maintain a minimum bend radius for optical fiber cables stored in wall box 200. *Holmberg*, [0041], [0043], [0045], [0053], Figs. 3, 6-7.

56. Both *Holmberg* and the ’483 Patent are in the same field of endeavor. Specifically, *Holmberg* and the ’483 Patent are both directed to systems that include an enclosure (e.g., wall box, drop interface box (DIB)) for connecting “an optical fiber feed or ‘drop’ cable from an optical fiber service provider to a distribution point[.]” ’483 Patent, 1:15-17, 1:19-21; *Holmberg*, [0003]-[0004], [0010]-[0011], [0034]-[0035], [0051]-[0053], Figs. 1-2, 6. Additionally, *Holmberg* and the ’483 Patent are directed towards “a drop interface box (DIB) for interfacing between an

optical network service provider's heavy jacketed drop cable and optical distribution cables at a premises." '483 Patent, 2:3-6; *Holmberg*, [0003]-[0004], [0006], [0034]-[0035], [0051]-[0053], Figs. 1-2, 6.

57. *Holmberg* is also reasonably pertinent to a problem addressed by the '483 Patent. In particular, *Holmberg* is directed to the problem of storing various optical fiber cables within an enclosure (e.g., a wall box) and also utilizing spools to store cables and to provide a minimum bend radius for the cables to prevent damaging said cables. Compare *Holmberg*, [0041], [0043], [0045], [0052]-[0053], with '483 Patent, 5:21-26, 5:34-43, Fig. 5-4.

B. Overview of Battey

58. *Battey* (Ex. 1005) teaches an optical connection closure that receives optical fibers and drop cables to "establish desired optical connections in a fiber optic communications network[.]" *Battey*, [0008], [0025], [0027]. *Battey* teaches connection closure 20 includes base 26 and cover 28, where "cover 28 is hingedly affixed to the base 26 and adapted to be opened and closed thereon." *Battey*, [0033]. *Battey* further teaches work shelf 54 to which a splice tray is mounted. *Battey*, [0038]. Further, *Battey* teaches shelf 54 is "hingedly affixed to an interior wall of the base 26 of the connection closure 20 at one or more hinge locations 56, thus allowing the shelf 54 to be rotated between an opened position for providing access to the splice tray and a closed position for storing the splice tray." *Battey*, [0039].

59. *Battey* and the '483 Patent are in the same field of endeavor. Specifically, *Battey* and the '483 Patent are both directed to systems that include an enclosure for interfacing between an optical fiber feed or drop cable from an optical fiber service provider to a distribution point. '483 Patent, 1:15-17, 1:19-21; *Battey*, [0003], [0008], [0025], [0027]. Additionally, *Battey* and the '483 Patent are directed towards “a drop interface box (DIB) for interfacing between an optical network service provider’s heavy jacketed drop cable and optical distribution cables at a premises.” '483 Patent, 2:3-6; *Battey*, [0005], [0008], [0025], [0027], [0030].

60. *Battey* is also reasonably pertinent to a problem addressed by the '483 Patent. In particular, *Battey* is directed to the problem of using a splice tray with a hinged connection to a base unit. Compare *Battey*, [0033], [0038]-[0039], Fig. 3, with '483 Patent, 4:49-53.

C. Overview of Blankenship

61. *Blankenship* (Ex. 1006) teaches an enclosure for interfacing between an optical fiber feed or drop cable from an optical fiber service provider to a distribution point that includes an adapter bracket that is configured to hold one or more adapters which couple a plurality of feed break-out cables to a plurality of distribution cables. In particular, *Blankenship* teaches a backplate 30 in the interior of base 12 of NID 10. *Blankenship*, 3:33-49, 3:64-4:1, 4:19-39, 4:61-5:8, 5:26-32, 5:57-59, Figs. 4-6.

62. *Blankenship* and the '483 Patent are in the same field of endeavor. Specifically, *Blankenship* and the '483 Patent are both directed to systems that include an enclosure for interfacing between an optical fiber feed or drop cable from an optical fiber service provider to a distribution point. '483 Patent, 1:15-17, 1:19-21; *Blankenship*, 1:7-11, 1:14-33, 3:10-15, 5:16-26, 6:28-40, 8:1-6, Fig. 6. Additionally, *Blankenship* and the '483 Patent are directed towards “a drop interface box (DIB) for interfacing between an optical network service provider’s heavy jacketed drop cable and optical distribution cables at a premises.” '483 Patent, 2:3-6; *Blankenship*, 1:7-11, 1:14-33, 3:10-15, 5:16-26, 6:28-40, 8:1-6, Fig. 6.

63. *Blankenship* is also reasonably pertinent to a problem addressed by the '483 Patent. In particular, *Blankenship* is directed to the problem of storing various optical fiber cables within an enclosure (e.g., a wall box) and also utilizing spools to store cables and to provide a minimum bend radius for the cables to prevent damaging said cables. Compare *Blankenship*, 6:28-56, 7:5-8, 7:56-59, Fig. 6, with '483 Patent, 5:21-26, 5:34-43, Fig. 5-4.

D. Overview of Cowen

64. *Cowen* (Ex. 1007) and the '483 Patent are in the same field of endeavor. Specifically, *Cowen* and the '483 Patent are both directed to systems that fiber optic housing for connecting and managing optical fibers. '483 Patent, 1:15-17, 1:19-21; *Cowen*, 3:50-4:18, 27:41-28:7. Additionally, *Cowen* and the '483 Patent are directed

towards enclosures for connecting optical fiber cables. '483 Patent, 2:3-6; Cowen, 2:53-60, 25:7-21, 8:28-50, 17:30-33.

65. *Cowen* is also reasonably pertinent to a problem addressed by the '483 Patent. In particular, *Cowen* is directed to the problem of using clips for management and routing of optical fiber cables within an enclosure. Compare *Cowen*, 3:50-4:18, 27:41-28:7, Figs. 26B, 26C, 28, with '483 Patent, 2:3-15, 3:6-16, 4:58-66, 5:21-29.

X. OPINIONS REGARDING GROUND 1: CLAIMS 1 AND 11 ARE OBVIOUS OVER *HOLMBERG* IN VIEW OF *BATTEY*

A. Claim 1(Pre): “A drop interface box configured to be mounted to a structure and to receive a drop cable from an optical fiber service provider distribution point and a plurality of distribution cables which distribute the optical fiber service, the drop interface box comprising:”

66. As I noted above, I have applied the “second construction” of “drop cable” in my analysis for Ground 1. See Section III.D.

67. To the extent the preamble is limiting, *Holmberg* teaches the claimed drop interface box configured to be mounted to a structure. Specifically, I note that *Holmberg* teaches wall box 200, which stores lengths of various fiber optic cables. *Holmberg*, [0034], [0037], [0041], [0048], [0052]-[0053]. For example, *Holmberg* teaches wall box 200 receives and stores jacketed cable, terminated fibers, and distribution cables. I note that I opine regarding terminated fibers and distribution cables in detail below for Claim 1(d). See Claim 1(d). Regarding jacketed cable, *Holmberg* teaches wall box 200 receives a jacketed cable and that the jacketed cable

is clamped at clamping portion 310 of wall box 200. *Holmberg*, [0052] (“Jacketed portions of the cable located adjacent to the stripped portion are preferably inserted within the clamping portions 310. Thereafter, the cable cover 226 is fastened to the main body 216 thereby covering the rear open region 222 and causing the jacketed portions of the cable to be clamped within the clamping portions 310.”). *Holmberg* teaches wall box 200 includes openings 232 that allow the “portions of the telecommunications cable located upstream and downstream of the mid-span access location to enter and exit the enclosure 202.” *Holmberg*, [0037], [0046]-[0048], [0052]-[0054], Figs. 3-10. Further, I note that *Holmberg* teaches half cylinders 312 and 314 where “jacketed portions of the cable are preferably inserted between the half cylinders 312, 314 of two of the coaxially aligned clamping portions 310.” *Holmberg*, [0048]. In my opinion, said half cylinders 312, 314 help form cable openings and exits 232 including because *Holmberg* teaches the half cylinders 312, 314 “provide mechanical retention of the cable and also provide a seal around the perimeter of the cable jacket.” *Holmberg*, [0048].

68. I also note that in addition to teaching wall box 200 receives a jacketed cable, *Holmberg* teaches that at least a portion of the jacket of the jacketed cable is stripped in the interior of wall box 200 proximate to the cable entrance of wall box 200. Specifically, *Holmberg* teaches “the cable is initially prepared by stripping away the outer jacket of the cable for a desired length at the mid-span location. In

one embodiment, about 4 feet of the outer jacket can be stripped.” *Holmberg*, [0052].

Thus, *Holmberg* teaches at least a portion of the jacketed cable has its jacket removed within wall box 200. *Holmberg* teaches cable management members 260 for storing a length of jacketed cable (for example, with the jacket stripped) within wall box 200:

The bend radius limiters 264 are positioned within the enclosure 202 so as to define a spool arrangement configured for allowing excess fiber optic cable to be spooled or looped around the four bend radiu[s] limiters 264. The cable management members 260 also include cable retention members 268 that project laterally outwardly from front ends of the bend radius limiters 264. The cable retention members 268 function to prevent cable looped around the bend radius limiters 264 from migrating forwardly past the front ends of the bend radius limiters 264.

Holmberg, [0041].

69. Regarding terminated fibers, *Holmberg* teaches the jacketed cable encloses fibers which are cut (“terminated fibers”) to be spliced to fibers of a distribution cable that is routed to a premises, such as a multi-dwelling unit. *Holmberg*, [0053] (“To access fibers within the wall box 200, selected fibers from the cable can be terminated (i.e., cut) adjacent one of the clamping portions 310 so as to provide a length of terminated fiber within the enclosure 202. The length of terminated fiber can be spooled around the spool structure 298 of the splice tray 230

for storage purposes.”), *id.* (“When it is desired to splice one of the terminated fibers to a distribution cable, the terminated fiber can be accessed from the spool structure 298 and routed through one of the openings 296 in the splice tray 230 to the front side of the splice tray 230.”).

70. In detail, *Holmberg* teaches splicing the terminated fibers to a plurality of fibers of a distribution cable. *Holmberg*, [0053] (“At the front side of the splice tray, the terminated optical fiber can be spliced to a corresponding fiber of another cable (“e.g., a distribution cable) with the splice being mounted at the splice sleeve holder 294 as shown at FIG. 12.”). Additionally, *Holmberg* teaches distribution cables have “on the order of 12 to 48 fibers; however, alternative implementations may include fewer or more fibers.” *Holmberg*, [0005]. Further, *Holmberg* teaches splitting said 12 to 48 fibers into “for example, 216 to 432 individual distribution fibers that may be associated with a like number of end user locations.” *Holmberg*, [0004]. Indeed, *Holmberg* teaches “terminated optical fiber can be spliced to a corresponding fiber of another cable (“e.g., a distribution cable[.]” *Holmberg*, [0053], [0006] (“facilitating coupling the fibers of the branch cable [drop cable] to a plurality of different subscriber locations.”), [0005]-[0007] (describing extending fiber optic networks to multi-dwelling units where a plurality of wall boxes each has “optical coupling locations corresponding to a plurality of different subscribers (e.g., each resident on a given floor).”). Therefore, in my opinion, a POSITA would have

understood from *Holmberg* or at least found obvious that a plurality of terminated fibers are connected to a plurality of distribution fibers, which are in turn “associated with a like number of end user locations.” *Holmberg*, [0003]-[0007], [0034]. Further, I note that a POSITA would have understood that *Holmberg*’s plurality of fibers of at least one distribution cable would have met the claimed “distribution cables” because *Holmberg*’s distribution cable fibers (to which terminated fibers are spliced) distribute optical fiber service to a plurality of subscribers or end locations.

71. Regarding storing excess distribution cable slack, a POSITA would have understood that *Holmberg* teaches storing excess distribution cable fiber slack using fiber storage walls 292 of splice tray 230. *Holmberg*, [0053] (“[E]xcess fiber can be stored by wrapping the excess fiber around the fiber storage walls 292 at the front side of the splice tray 230.”). *Holmberg* teaches that fiber storage walls 292 also include fiber retention fingers 294 that “project inwardly from the perimeter wall 290 and outwardly from the fiber storage walls 292 and function to assist in retaining fibers within the area defined between the wall 290 and the walls 292.” *Holmberg*, [0043]. I discuss *Holmberg*’s teachings regarding storing distribution cable slack in more detail below. See Claim 1(d), ¶¶106-110. Thus, *Holmberg* teaches cable management members 260 for storing excess jacketed cable where the jacket is stripped, spool structure 298 for storing slack of terminated fibers, and fiber storage walls 292 for storing excess slack of distribution fibers.

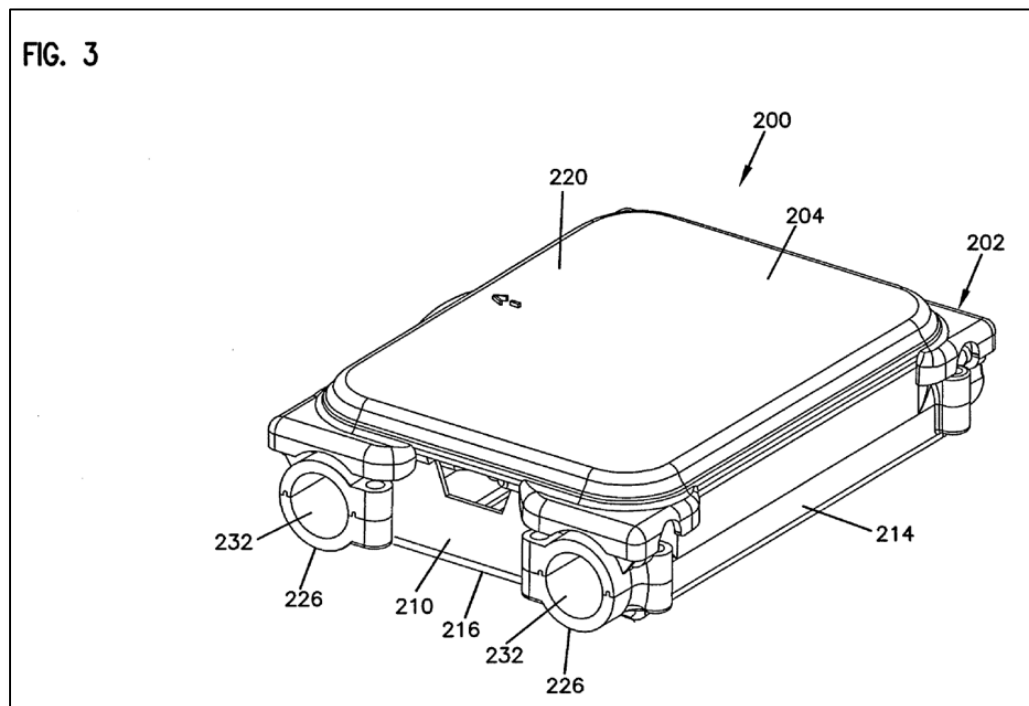
72. In my opinion, a POSITA would have understood or at least found obvious that *Holmberg* teaches jacketed cable comes from an optical network service provider. As an initial point, *Holmberg* explains that the technical background underlying its disclosure is optical network service providers seeking to deliver optical communications to end customers. *Holmberg*, [0003] (“Passive optical networks are becoming prevalent in part because service providers want to deliver high bandwidth communication capabilities to customers.”). As I discussed above, in *Holmberg*’s box, the jacketed cable is stripped, the terminated fibers are spliced to fibers of distribution cables, and said distribution cables are routed to, for example, a multi-dwelling unit or end users. *Holmberg* teaches wall box 200 is “for use in a fiber optic network.” *Holmberg*, [0008]. *Holmberg* also teaches an exemplary fiber optic network, which a POSITA would have understood or found obvious would have functioned similarly or the same as a fiber optic network in which wall box 200 is utilized. Indeed, *Holmberg* teaches mounting wall box 200 for use in a fiber optic network “along the length of a fiber optic telecommunications cable.” *Holmberg*, [0034]. Further, *Holmberg* teaches fiber optic service provided to a plurality of subscribers. *Holmberg*, [0003]-[0007], [0034]. As I opined above, *Holmberg* teaches wall box 200 interfaces between an optical network service provider’s jacketed drop cable and optical distribution cables by stripping a length of jacket from the jacketed cable, cutting fibers to create terminated fibers, and

splicing terminated fibers to fibers of distribution cables. Indeed, such was common and well understood in the art, as I discussed above. *See* Section V. Therefore, in my opinion, a POSITA would have understood or at least found obvious that *Holmberg's* jacketed cable is from an optical fiber service provider distribution point. *Holmberg*, [0034], [0037], [0048], [0052]-[0053].

73. In my opinion, to the extent it is argued that *Holmberg* does not expressly teach converting or splicing distribution cables (e.g., a plurality of fibers of one or more distribution cables) into terminating fibers to reach individual subscribers or other end customers, a POSITA would have found it obvious to connect said terminating fibers to fibers of at least one distribution cable. Indeed, *Holmberg* specifically teaches coupling fibers of a drop cable (e.g., terminated fibers) to a plurality of different subscriber locations, such as apartment buildings, to provide service to a plurality of subscribers. *Holmberg*, [0005]-[0007], [0053] (“terminated optical fiber can be spliced to a corresponding fiber of another cable (e.g., a distribution cable)[.]”). Therefore, in my opinion, a POSITA would have found obvious that *Holmberg's* plurality of distribution cables would have distributed optical fiber service to a plurality of different subscribers.

74. *Holmberg* teaches wall box 200 is configured to be mounted to a “vertical surface such as a pole or wall[.]” *Holmberg*, [0051]. Indeed, *Holmberg* teaches the “present disclosure relates generally to wall boxes configured to be easily

mounted at mid-span locations along the length of a fiber optic telecommunications cable.” *Holmberg*, [0034]. Further, *Holmberg* teaches the wall boxes are “to be used for indoor applications such as multi-dwelling units, or commercial buildings where a plurality of subscribers is located” but that the wall box “can be used for either indoor or outdoor applications wherever it is desired to easily mount an enclosure[.]” *Id.* *Holmberg* also teaches wall box 200 may be “readily mounted to the wall, pole or other structure.” *Holmberg*, [0051], [0055] (“the main body is mounted to a structure such as a wall or a pole.”), [0035].



Holmberg, Fig. 3.

B. Claim 1(a): “a base unit having a drop cable entrance configured to receive the drop cable and having drop cable retaining mechanisms spaced apart and configured to retain a length of drop cable looped around the drop cable retaining mechanisms;”

75. As I noted above, I have applied the “second construction” of “drop cable” in my analysis for Ground 1. *See* Section III.D.

76. *Holmberg* teaches the claimed base unit, namely, main body 216 of wall box 200. For example, *Holmberg* teaches “FIGS. 3-12 show a wall box 200 having features in accordance with the principles of the present disclosure. The wall box 200 includes a generally rectangular enclosure 202 including a front side 204, a back side 206, a top side 208, a bottom side 210, a right side 212 and a left side 214.” *Holmberg*, [0035]. Additionally, *Holmberg* teaches the “enclosure 202 also includes a front cover 220 pivotally mounted to the main body 216. The front cover 220 is movable between a first position (shown in FIG. 3) where the open front side 218 of the main body 216 is covered, and a second position (shown in FIG. 4) where the open front side 218 of the main body 216 is exposed so as to allow access into the interior of the enclosure 202 from the front side 204 of the enclosure 202.” *Id.* *See also Holmberg*, [0037]-[0038], [0040]-[0041], [0045] further teaching main body 216 of wall box 200 includes cable management members 260 and hinge pins 242 formed within main body 216 for attaching front cover 220. Fig. 6 below depicts main body 216 and front cover 220:



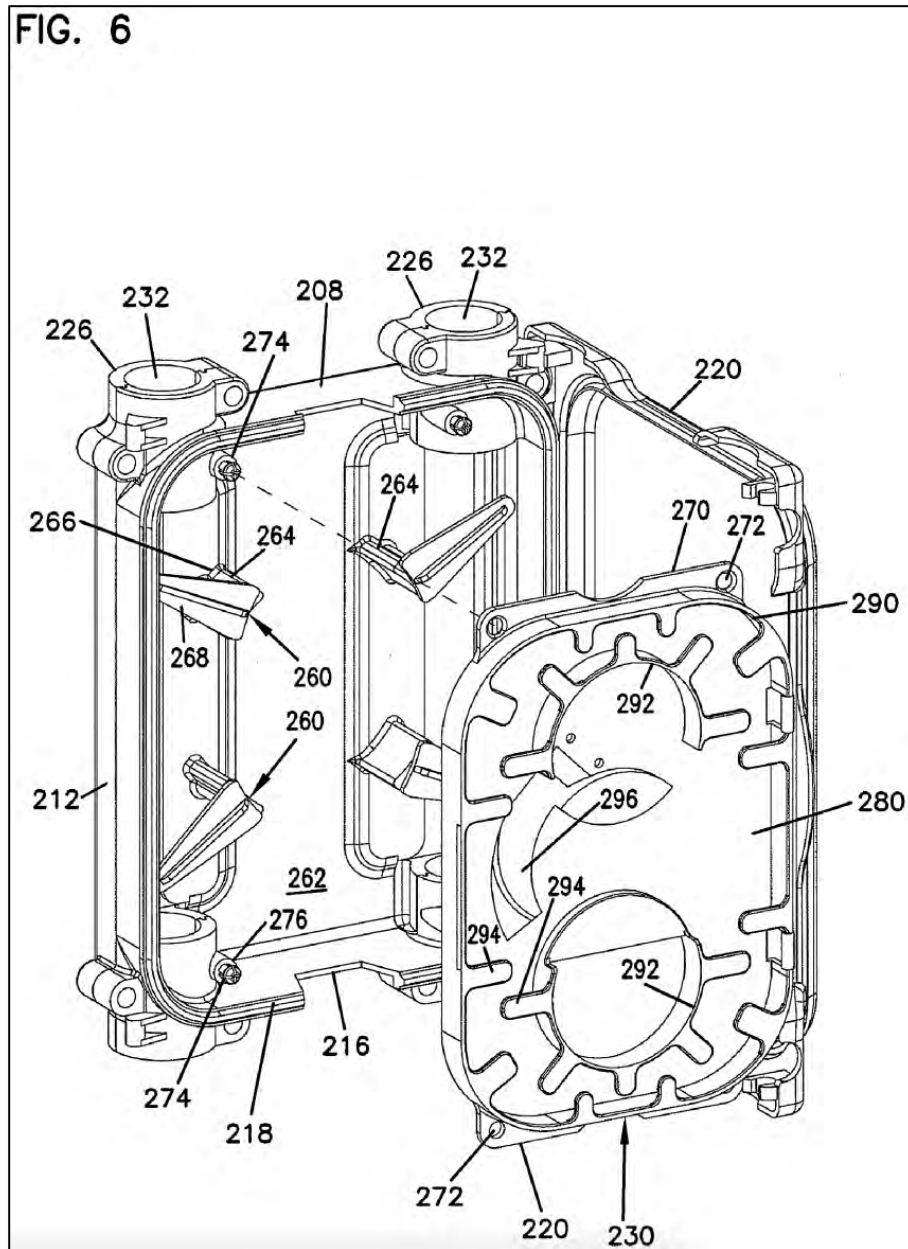
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[0054], Figs. 3-10. Therefore, a POSITA would have understood or at least found obvious that wall box 200 receives a jacketed cable (“drop cable”) in main body 216 via a drop cable entrance. *See* Claim 1(Pre). Further, as I opined above, the jacketed cable has a portion of the jacket stripped within wall box 200. *Holmberg*, [0052]-[0053]; *see* Claim 1(Pre).

78. As I discussed above regarding Claim 1(Pre), *Holmberg* teaches main body 216 includes cable management members 260 for storing a length of jacketed cable (for example, with at least a portion of the jacket stripped) within wall box 200 where the cable is wrapped around four bend radius limiters 264 and where cable retention members 268 prevent looped cable from moving off the front ends of the bend radius limiters 264:

The bend radius limiters 264 are positioned within the enclosure 202 so as to define a spool arrangement configured for allowing excess fiber optic cable to be spooled or looped around the four bend radiu[s] limiters 264. The cable management members 260 also include cable retention members 268 that project laterally outwardly from front ends of the bend radius limiters 264. The cable retention members 268 function to prevent cable looped around the bend radius limiters 264 from migrating forwardly past the front ends of the bend radius limiters 264.

Holmberg, [0041], [0045], [0052] (“The stripped portion of the cable can then be spooled around the bend radius limiters 264 provided within the main body 216.”).



Holmberg, Fig. 6; see also *Holmberg*, Figs. 3-4.

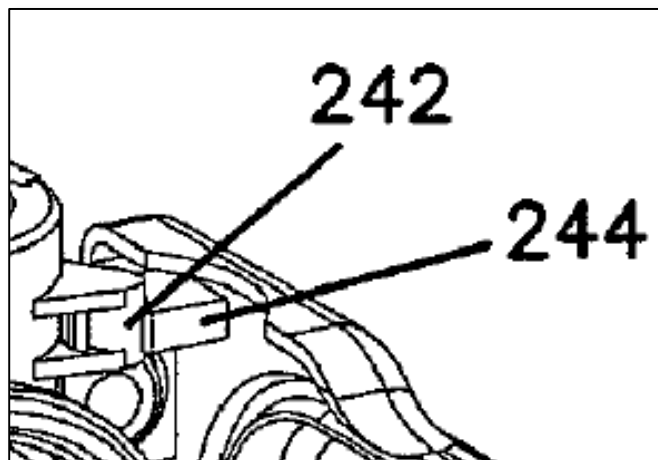
C. Claim 1(b): “a cover having a hinged connection to the base unit to selectively enclose a storage area provided in the base unit; and”

79. As I opined above, *Holmberg* teaches a main body 216 (“base unit”) and a front cover 220 (“cover”) of wall box 200. *See* Claim 1(Pre), 1(a). I note that

Holmberg also teaches that the front cover 220 of wall box 200 is “pivotally mounted to the main body 216” via a pair of hinge pins 242 and hinge pin receivers 244.

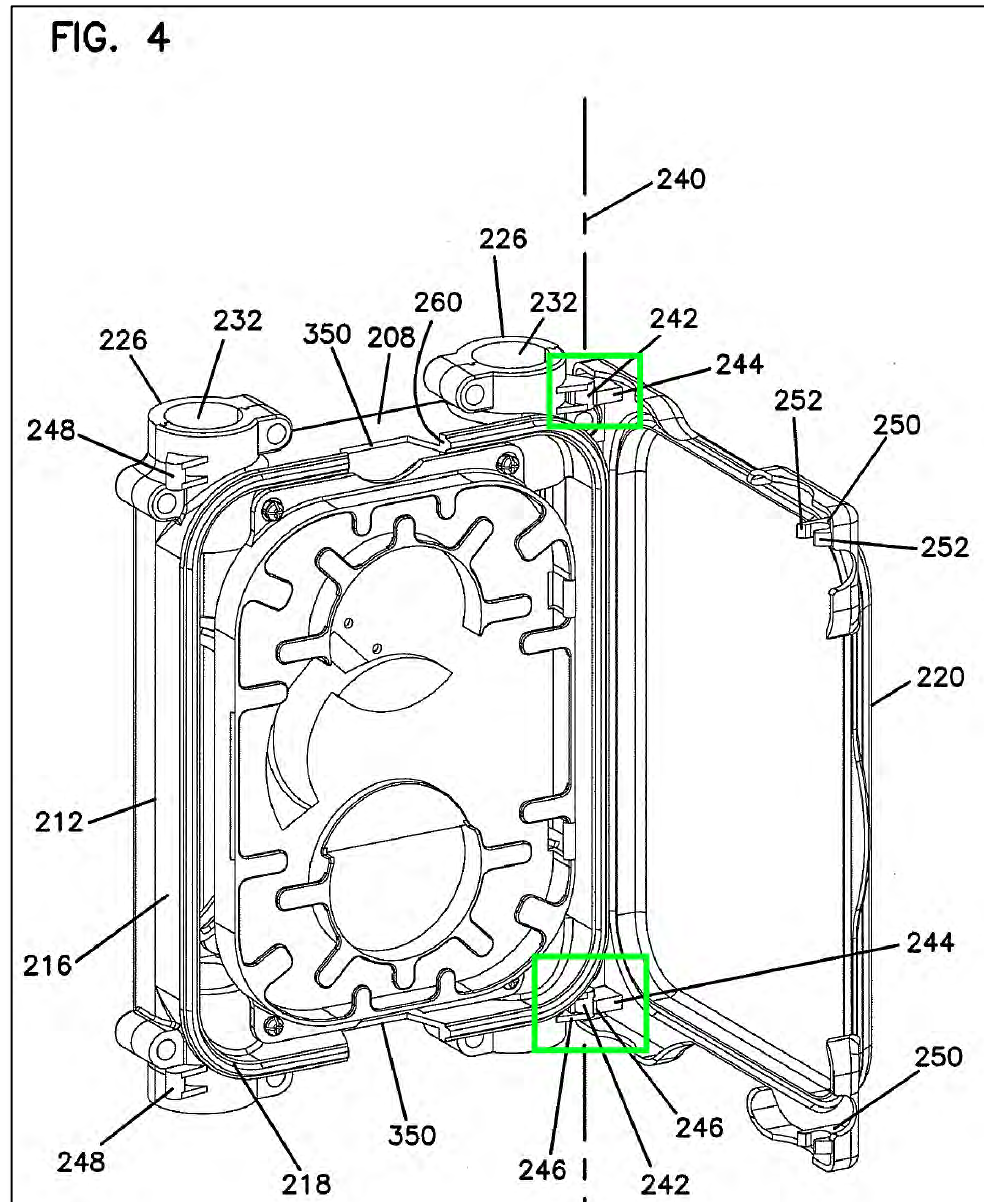
As shown best at FIGS. 4-11, the front cover 220 is pivotally connected to the main body 216 at a vertical pivot axis 240 (see FIG. 4) located generally adjacent a front left edge of the main body 216. The pivotal connection between the front cover 220 and the main body 216 is provided by a hinge arrangement including a pair of hinge pins 242 integrally formed with the main body 216 and a pair of hinge pin receivers 244 integrally formed with a back side of the front cover 220. The hinge pin receivers 244 each include a pair of opposing, flexible arms 246 that defines a pocket into which the hinge pins 242 can be snapped to provide the pivotal connection between the front cover 220 and the main body 216.

Holmberg, [0038], *see also* [0039]. The excerpt of Fig. 4 below depicts a hinge pin 242 and a hinge pin receiver 244 to pivotally mount front cover 220 to main body 216:

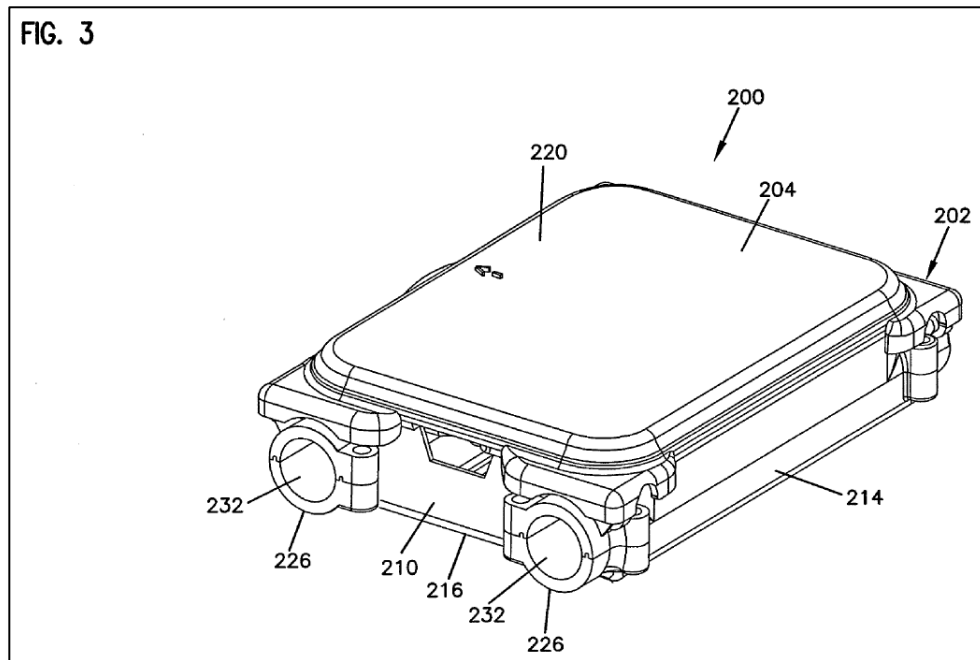


Holmberg, Fig. 4 (excerpt).

80. Further, annotated Fig. 4 below depicts front cover 220 in an open position and connected to main body 216 via hinge pins 242 and hinge pin receivers 244 (boxed in green):



Holmberg, Fig. 4 (annotated). *Holmberg* teaches front cover 220 is in an open position as depicted in Fig. 4 above and in a closed position as depicted in Fig. 3 below:



Holmberg, Fig. 3, [0035].

81. *Holmberg*'s front cover 220 selectively encloses the interior of wall box 200 including enclosure 202 ("storage area") that is provided in main body 216 ("base unit"). *Holmberg* teaches "enclosure 202 includes a main body 216 defining an open front side 218. The enclosure 202 also includes a front cover 220 pivotally mounted to the main body 216." *Holmberg*, [0035]. Specifically, *Holmberg* teaches "front cover 220 is movable between a first position (shown in FIG. 3) where the open front side 218 of the main body 216 is covered, and a second position (shown in FIG. 4) where the open front side 218 of the main body 216 is exposed so as to

allow access into the interior of the enclosure 202 from the front side 204 of the enclosure 202.” *Id.* I note that *Holmberg* teaches main body 216 stores excess cable. Indeed, as I opined above, *Holmberg* teaches main body 216 stores jacketed cable with at least a portion of the jacket stripped using cable retaining mechanisms 260 as I opined above. *See* Claim 1(Pre), 1(a); *Holmberg*, [0041] (“The bend radius limiters 264 are positioned within the enclosure 202 so as to define a spool arrangement configured for allowing excess fiber optic cable to be spooled or looped around the four bend radiu[s]¹ limiters 264.”). With front cover 220 in a selectively closed position, *Holmberg*’s wall box 200 has front cover 220 selectively enclosing a storage area provided in main body 216 (“main body”), as claimed. Thus, a POSITA would have understood or at least found obvious that the interior of enclosure 202 would have provided a storage area in main body 216.

¹ I note that *Holmberg* states bend “radium” limiters 264 in one instance, which a POSITA would have understood to be a typographical error. Elsewhere, *Holmberg* refers to bend “radius” limiters 264. *Holmberg*, [0041], [0045], [0052]. I have corrected the typographical error “radium” to “radiu[s]” for ease of reading.

- D. Claim 1(c): “a fiber storage panel having a hinged connection to the base unit on a side opposite the hinged connection of the cover to the base unit such that the fiber storage panel is moveable relative to the base unit and configured to be stored between the base unit and the cover,”**

1. *Holmberg’s Teachings*

82. *Holmberg* teaches a splice tray 230 that stores terminated cable slack, distribution cable fiber slack, and provides an area for the terminated fibers to be spliced to distribution cable fibers, satisfying the claimed “fiber storage panel.” For example, *Holmberg* teaches splice tray 230 “mounts in the interior of the enclosure 202 and is accessible through the open front side 218 of the main body 216 when the front cover 220 is open.” *Holmberg*, [0035]. *Holmberg* further teaches “splice tray 230 also provides cable/fiber management within the interior of the enclosure 202.” *Holmberg*, [0042]. Splice tray 230 includes a spool structure 298 for spooling a length of terminated fiber for storage purposes and fiber storage walls 292 for storing excess distribution cable fiber. *Holmberg*, [0053]. In more detail, *Holmberg* teaches fiber storage walls 292 are partial spools that store excess fiber and provide bend radius protection.

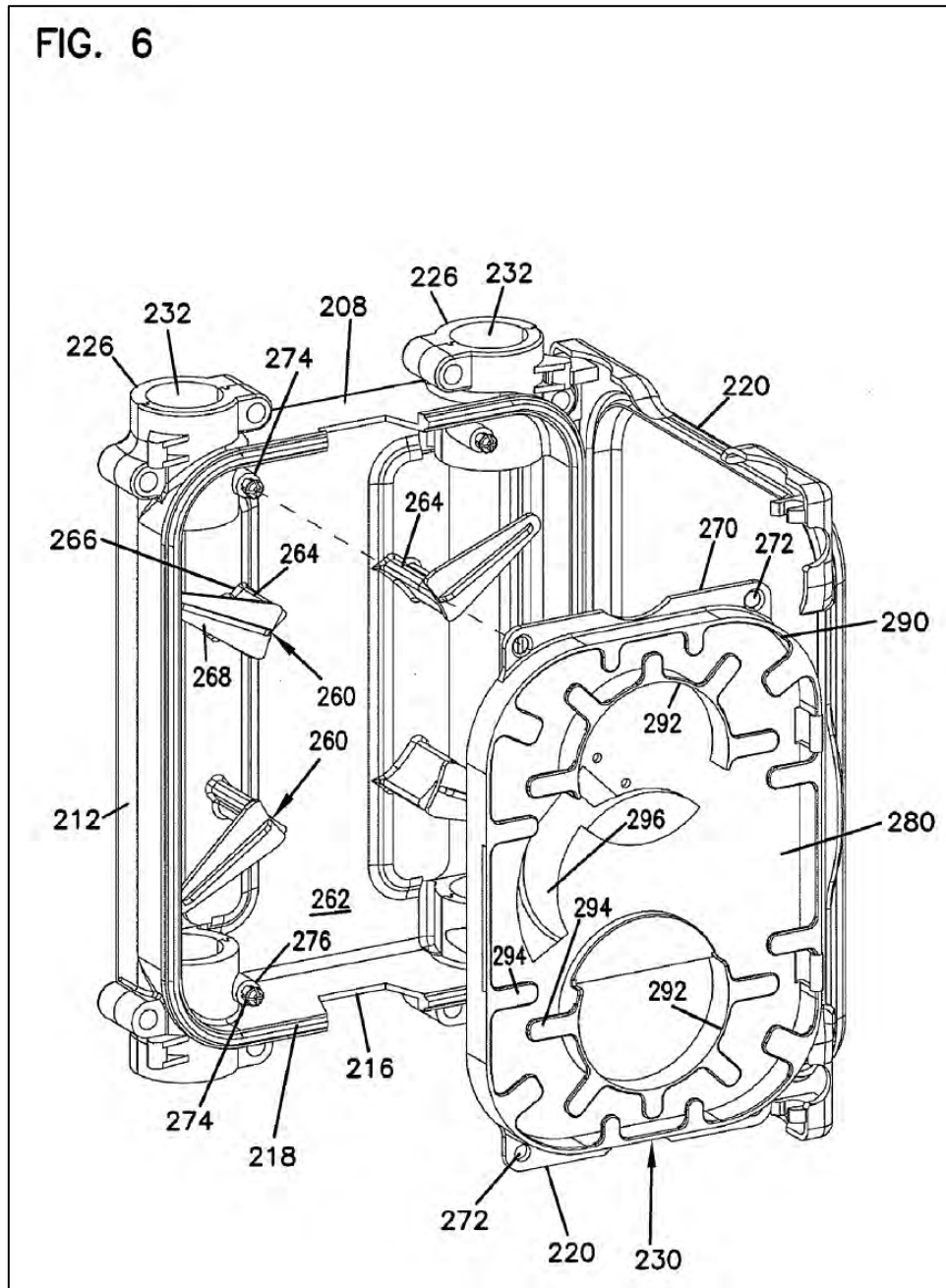
Two curved fiber storage walls 292 (e.g., partial spools) also project forwardly from the main panel 288. The fiber storage walls 292 have an outer curvature selected to provide bend radius protection to fibers routed about the exterior of the fiber storage walls 292. In use, excess fiber can be looped around the fiber storage walls 292 so as to form an elongated fiber storage loop at the front side of the main panel 280.

Fiber retention fingers 294 project inwardly from the perimeter wall 290 and outwardly from the fiber storage walls 292 and function to assist in retaining fibers within the area defined between the wall 290 and the walls 292.

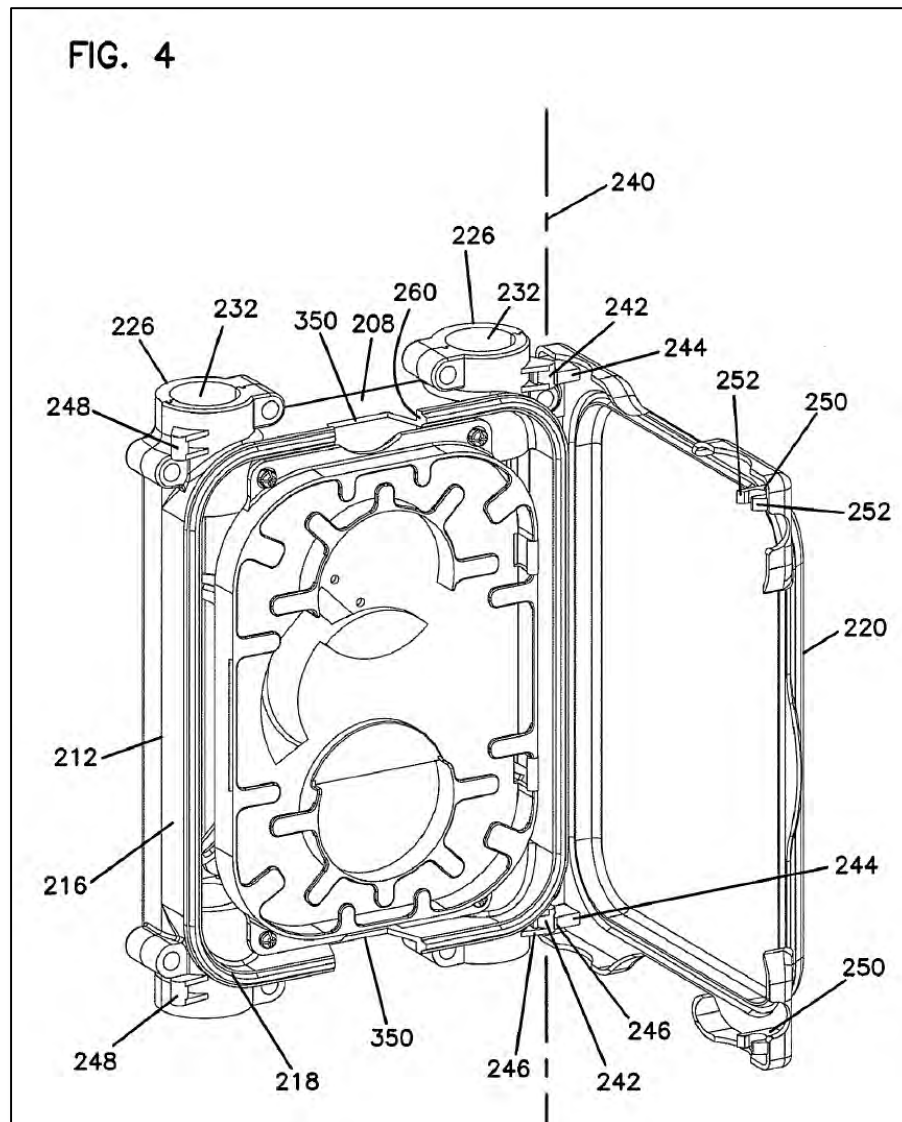
Holmberg, [0043].

83. I note that *Holmberg* teaches splice tray 230 is fastened to main body 216 via threaded fasteners and fastener openings 272 and bosses 274. *Holmberg*, [0042]. As depicted below in Figs. 4 and 6, *Holmberg* teaches splice tray 230 is configured to be stored between main body 216 and cover 220:

FIG. 6



Holmberg, Fig. 6.



Holmberg, Fig. 4, see also Fig. 3.

84. I note that *Holmberg* does not expressly teach a hinged connection between main body 216 and splice tray 230. However, such was well known in the prior art, including as taught by *Batthey*. Also, such was taught by *Castonguay*, as I discussed in the Overview of the Technology. See Section V.

2. *Batthey's Teachings*

85. *Battey* teaches an optical connection closure 20 for connecting a drop cable and optical fibers of a distribution cable in a fiber optic communications network. *Battey*, [0008]-[0011], [0025]-[0027], [0030]-[0031]. For example, *Battey's* connection closure 20 “permits an optical fiber of one or more pre-connectorized fiber optic drop cables 21 (FIG. 2) to be readily interconnected with a field terminated or factory preterminated and connectorized optical fiber 23 (FIG. 3) of a fiber optic distribution cable 25 (FIG. 2 and FIG. 3).” *Battey*, [0030].

86. I note that *Battey's* connection closure 20 comprises several components including “a base 26 and a cover 28 each made of a lightweight, yet rigid material, such as aluminum, plastic or thermoplastic.” *Battey*, [0033]. Additionally, *Battey* teaches the “base 26 is generally box-shaped and defines an interior cavity for housing the express portion of distribution cable 25, connectorized optical fibers 23 and optical hardware, such as splice trays, couplers, adapters, optical fiber routing and slack storage guides and the like.” *Id.* *Battey* also contemplates a “variety of shapes that is suitable for housing optical communications hardware” for base 26. *Id.* Regarding cover 28 and base 26, *Battey* teaches “the cover 28 is hingedly affixed to the base 26 and adapted to be opened and closed thereon.” *Battey*, [0033]. *Battey* teaches attaching the cover 28 to base 26 using hinge locations, clasps, or other conventional fasteners. *Battey*, [0033] (“As shown, the cover 28 is generally rectangular and is hingedly affixed to the base 26

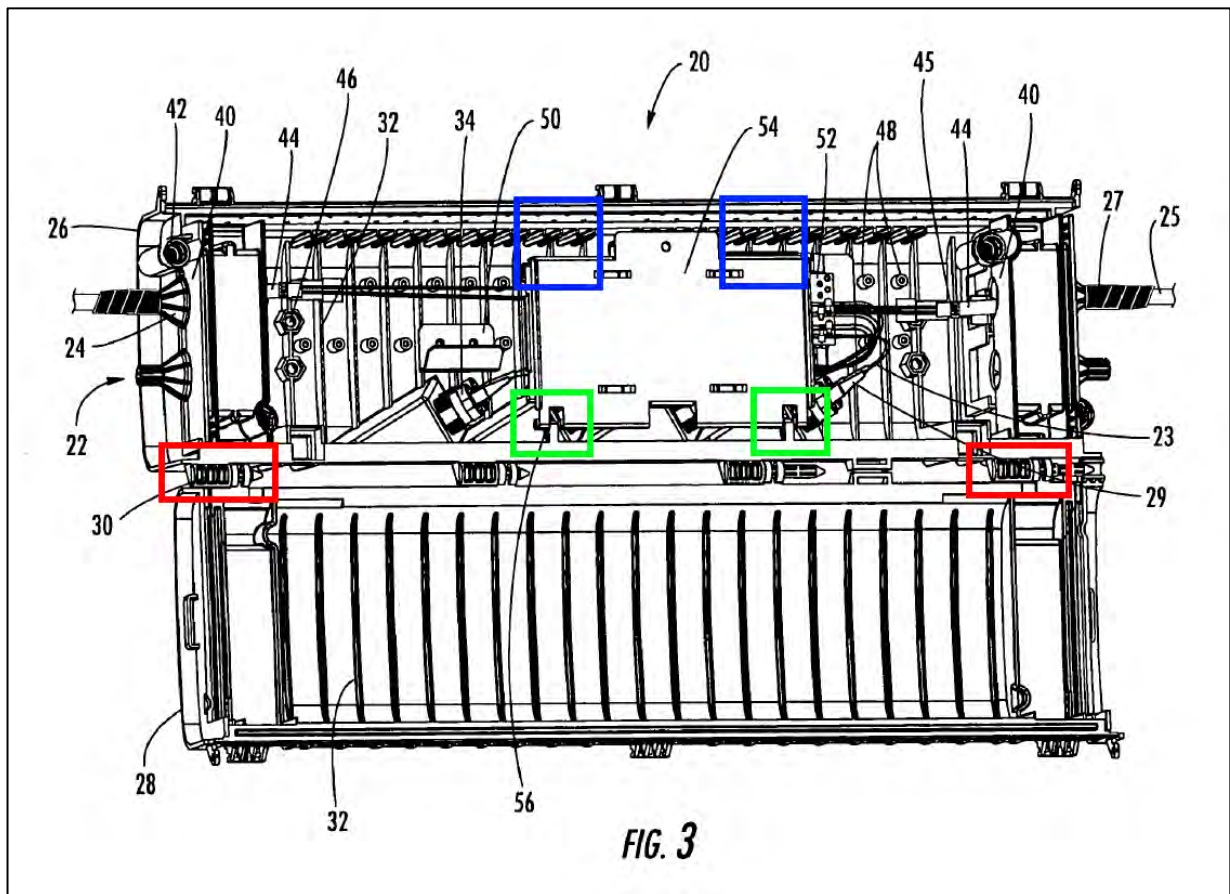
at one or more hinge locations 30.”), *id.* (“The base 26 and/or the cover 28 is preferably provided with clasps (not shown) or other conventional fasteners for securing the cover 28 to the base 26 in the closed configuration.”). Additionally, *Battey* teaches a sealing gasket between base 26 and cover 28 to “provide a seal against environmental elements such as wind-driven rain.” *Id.*

87. I note that *Battey* teaches using a splice tray, where “[s]plice trays are used when terminated or preterminated optical fibers are spliced in the field, such as when one or more optical fibers of the distribution cable 25 are accessed in the field to create a mid-span access location and spliced to interconnect the distribution cable with one or more drop cables 21.” *Battey*, [0036]. In particular, *Battey* teaches “a plurality of optical fibers of the distribution cable 25 are spliced to optical fibers having an optical connector 29 mounted thereon (i.e., a pigtail) to produce a corresponding plurality of connectorized optical fibers 23.” *Id.* *Battey* teaches that such splicing may be done “in any known manner, such as by fusion or mechanical splicing.” *Battey*, [0058]. I also note that *Battey* teaches said splice tray, which is a “conventional splice organizer or splice tray” is “mounted to a work shelf 54, preferably on the side of the shelf 54 facing the base 26.” *Battey*, [0038]. *Battey* teaches using more than one splice organizer or splice tray and that the “splice tray is adapted to receive any number of splices.” *Battey*, [0038].

88. Further regarding work shelf 54, *Battey* teaches hingedly affixing work shelf 54 to a wall of base 26. Specifically, *Battey* teaches “the shelf 54 is hingedly affixed to an interior wall of the base 26 of the connection closure 20 at one or more hinge locations 56, thus allowing the shelf 54 to be rotated between an opened position for providing access to the splice tray and a closed position for storing the splice tray.” *Battey*, [0039]. Additionally, *Battey* teaches that the “shelf 54 is movable relative to the base 26 to expose the splice tray to the field technician[.]” *Id.* *Battey* expressly teaches two different locations for hinge locations 56: a first location where “hinge locations 56 are located on the same side of the closure 20 as the hinge locations 30 that hingedly affix the cover 26 to the base 28” and a second alternative location, where “the hinge locations 56 may be located on the side of the closure 20 opposite the hinge locations 30.” *Battey*, [0039]. In either case, *Battey* teaches shelf 54 is “rotatable relative to the base 26 through an angle of at least about 90 degrees and as much as about 180 degrees between the opened position and the closed position, thus providing full and convenient access to the splice tray.” *Id.*

89. In at least one embodiment, work shelf 54 is hingedly connected to the base unit “on the side of the closure 20 opposite the hinge locations 30.” *Battey*, [0039]. Indeed, although *Battey*’s Fig. 3 below depicts hinge locations 56 on the same side of the closure as hinge locations 30, *Battey* expressly teaches that the hinges may alternatively be placed on the opposite side of closure 20. Annotated

Fig. 3 below depicts hinge locations 30 (annotated red) for connecting cover 28 to base 26, hinge locations 56 (annotated green) for connecting the work shelf 54 to base 26 in one embodiment, and blue boxes that a POSITA would have understood are exemplary locations at which hinge locations 56 would have been located in the embodiment expressly described in [0039]:



Bathey, Fig. 3 (annotated), [0039].

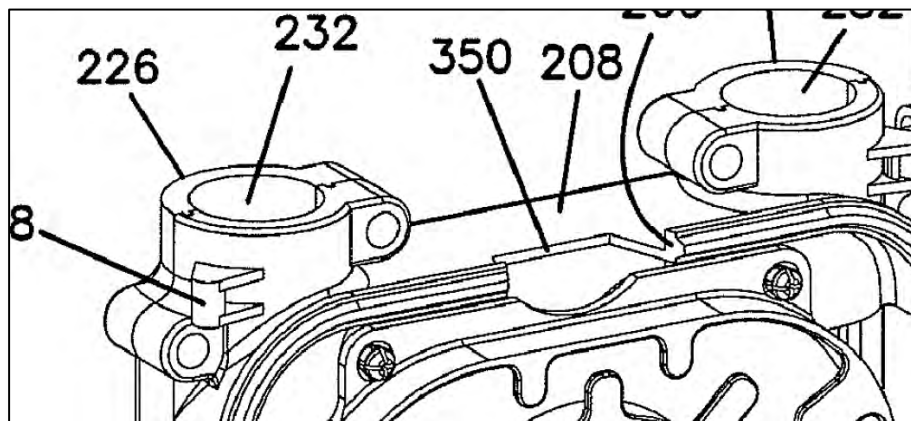
3. Motivation to Combine *Holmberg* and *Bathey*

90. A POSITA would have been motivated and found it obvious to modify *Holmberg* in light of *Bathey*'s teachings to use a hinged connection for splice tray

230 instead of *Holmberg's* native threaded fasteners. Such a modification would have advantageously provided convenient access to both sides of *Holmberg's* splice tray, which is an express advantage taught by *Battey*. I note that *Battey* teaches “shelf 54 is rotatable relative to the base 26 through an angle of at least about 90 degrees and as much as about 180 degrees between the opened position and the closed position, thus providing full and convenient access to the splice tray.” *Battey*, [0039]. Modifying *Holmberg* to utilize a hinged connection for splice tray 230 instead of threaded fasteners would have been a straightforward application of a known technique that would have improved *Holmberg* in the same way the hinged connections benefited *Battey*. As I discussed above in the Overview of the Technology, utilizing a hinged connection for a splice tray or fiber storage panel was well known, with *Castonguay* as one example. See Section V. Indeed, in my opinion, such an arrangement of hingedly affixing a cover to a main body on one side of the main body and hingedly affixing a splice tray on the opposite side of the main body was well known in the prior art.

91. It is also my opinion that a POSITA would have understood or at least found obvious that *Holmberg* does not teach away from utilizing a hinged connection for splice tray 230. I note that, during prosecution of the application that issued as the '483 Patent, the Applicant stated that *Holmberg* teaches away from hinged connections because *Holmberg* used threaded connectors. See Section VII. I

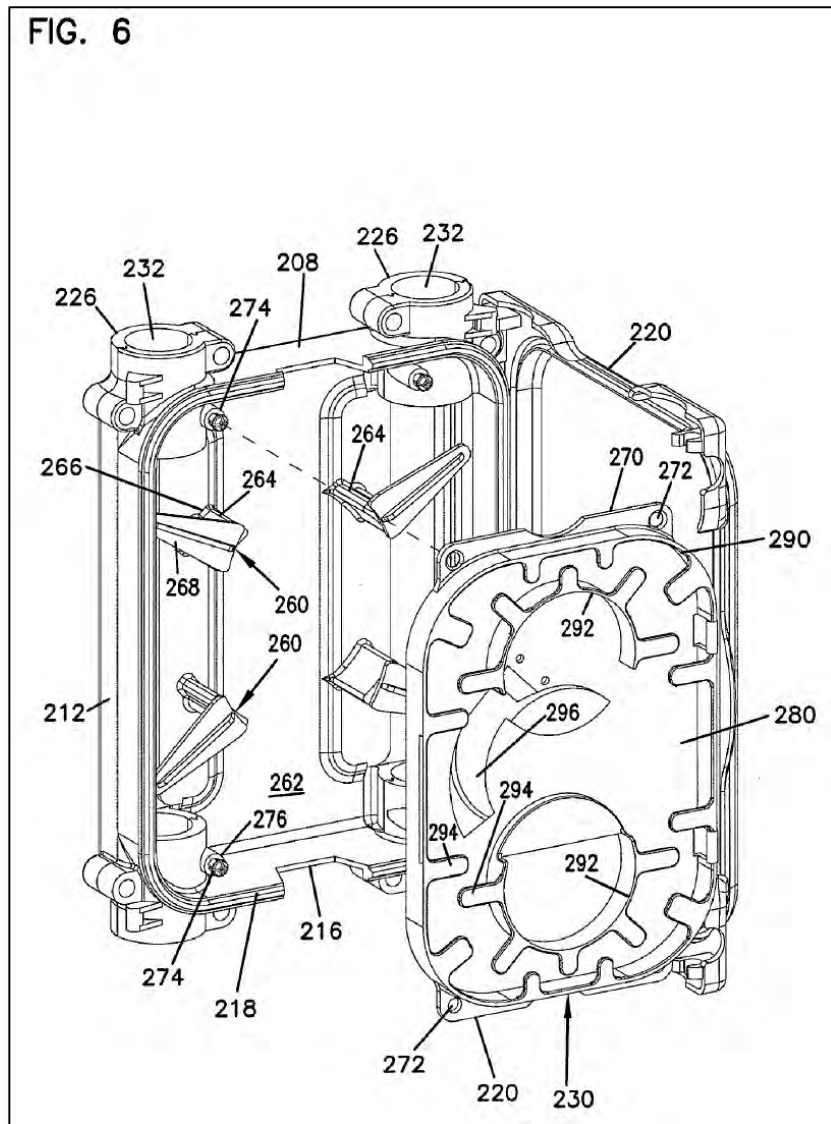
disagree. *Holmberg* disclosing a threaded fastener does not “criticize, discredit or otherwise discourage” a POSITA from using a hinged connection or another connection type aside from a threaded fastener. *Holmberg* simply discloses the use of threaded fasteners without comparing those fasteners to any alternative connection types. Importantly, *Holmberg* does not discredit the use of other types of connections (such as a hinged connection) or suggest that its splice tray is configured in a manner incompatible with other types of connections. *Holmberg* depicts threaded fasteners in Figs. 4 and 6, such as Philips head screws, which a POSITA would have understood are removable fasteners. A POSITA would further have understood that splice tray 230 is connected to main body 216 in a removable (i.e., non-permanent) manner. An excerpt of *Holmberg*’s Fig. 4 is depicted below:



Holmberg, Fig. 4 (excerpt), *see also* Fig. 6 (also depicting Philips head screws).

Holmberg does not teach splice tray 230 would have been permanently attached to main body 216 at least because *Holmberg*’s Fig. 6 depicts splice tray 230 as separate

from main body 216 and because of the depiction of Philips head screws, which a POSITA would have understood are removable connectors.



Holmberg, Fig. 6. Given the removable relationship between splice tray 230 and main body 216, a POSITA would have understood that non-permanent attachment mechanisms such as hinges are compatible with *Holmberg's* box.

92. A POSITA would have been motivated to modify *Holmberg* to utilize a hinged connection such as taught by *Battey* to advantageously provide easier access to *Holmberg*'s splice tray (including the rear side) and because using a hinged connection was a known solution for attaching a splice tray in a wall box (or connection closure, as taught by *Battey*). Further, such a modification would have improved access to components located behind *Holmberg*'s splice tray, such as the drop cable. Indeed, such a modification would have been a simple substitution of using a hinged connection instead of threaded fasteners and would have yielded the predictable result of a splice tray that is rotatable and hingedly connected to the base unit (or "main body," as taught by *Holmberg*) on a side opposite where the cover is hingedly connected to the base unit (or main body). Further, modifying *Holmberg* according to *Battey*'s teachings would have resulted in *Holmberg*'s splice tray moveable relative to main body 216 and where splice tray 230 would have been configured to be stored between main body 216 and cover 220 in a selectively closed position.

93. When modifying *Holmberg* according to *Battey*'s teachings, a POSITA would have had a reasonable expectation of success for several reasons. As I discussed above, using a hinged connection for a splice tray was well known in the art, as taught by *Battey* and as I discussed in the Overview of the Technology (where I opined regarding *Castonguay*). See Section V. It is my opinion that modifying

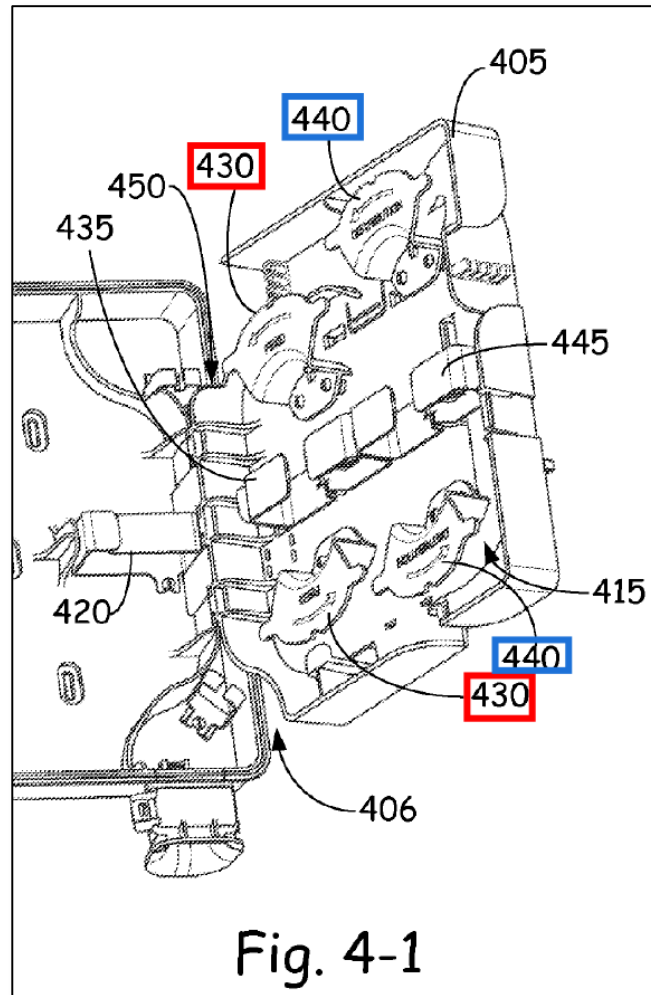
Holmberg to use a hinged connection for splice tray 230 instead of threaded fasteners would have been a straightforward modification that would not have required undue experimentation. Indeed, I note that *Holmberg* teaches using a hinged connection for connecting front cover 220 to main body 216, such that modifying *Holmberg* to also use a hinged connection for splice tray 230 would have been straightforward and well within the skillset of a POSITA. Accordingly, modifying *Holmberg* to use a hinged connection for splice tray 230 per *Battey's* teachings would have had a reasonable expectation of success.

- E. Claim 1(d): “the fiber storage panel having first spools positioned to store a plurality of feed break-out cables coupleable to the drop cable, the fiber storage panel further having second spools positioned to store a plurality of distribution cables coupleable to the plurality of feed break-out cables.”**

94. As I opined above, *Holmberg* in view of *Battey* teaches the claimed fiber storage panel. *See* Claim 1(c). I also opined above that *Holmberg* teaches terminated fibers (“feed break-out cables”) and distribution cables. *See* Claim 1(Pre).

1. The '483 Patent's Use of the Term “Spools”

95. The '483 Patent describes “two sets of spools 430 and 440[.]” '483 *Patent*, 4:62-66, 5:30-43 (“pairs of cable storage spools 430 and 440[.]” “spools 430[.]” “spools 440”). Fig. 4-1 below depicts first “spools 430” that “store feed cables” and second “spools 440” that “store distribution cables[.]” *Id.*



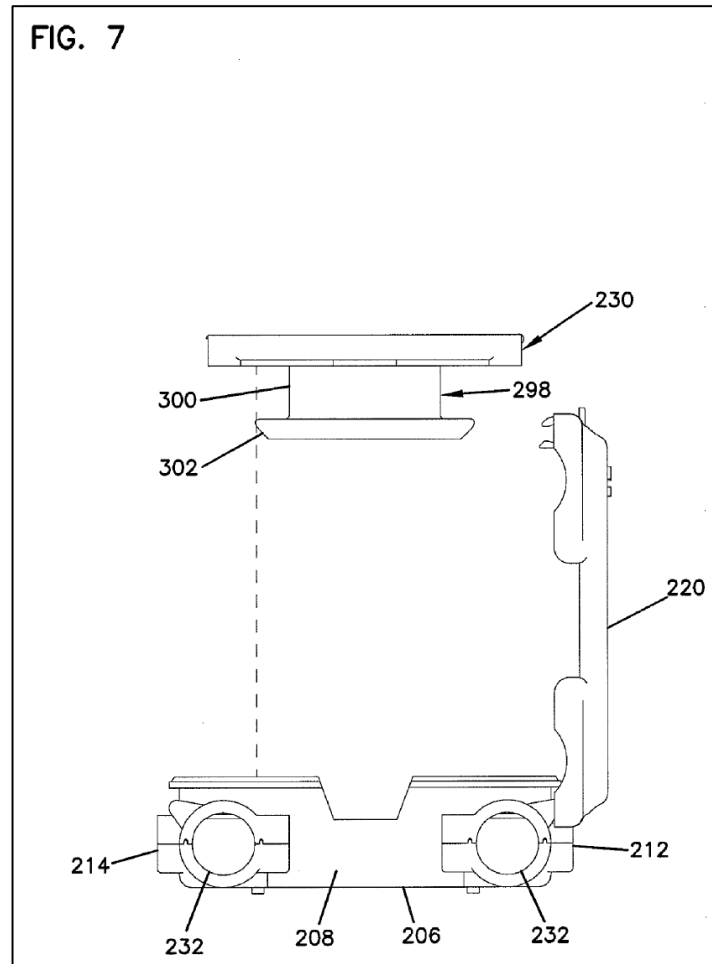
'483 Patent, Fig. 4-1 (excerpt, annotated). Accordingly, the '483 Patent describes plural "spools" that refer to a single set of curved structures. The set of curved structures together provides at least the functionality that a single spool provides. Specifically, a cable may be fully wrapped around a single solid, circular spool in the same manner as being wrapped around two curved structures that are separated by some distance. I note the '483 Patent describes the plural "spools" for each set of half circles / curved structures. Therefore, in my opinion, the claimed "first spools" is satisfied by a set of half circles or similar curved structures that, jointly, allow

cabling to be wrapped around them, e.g., similar to “spools 430” in Fig. 4-1 above.

In the same manner, the claimed “second spools” is also satisfied by a set of half circles or similar curved structures that, jointly, allow cabling to be wrapped around them, e.g., similar to “spools 440” in Fig. 4-1 above.

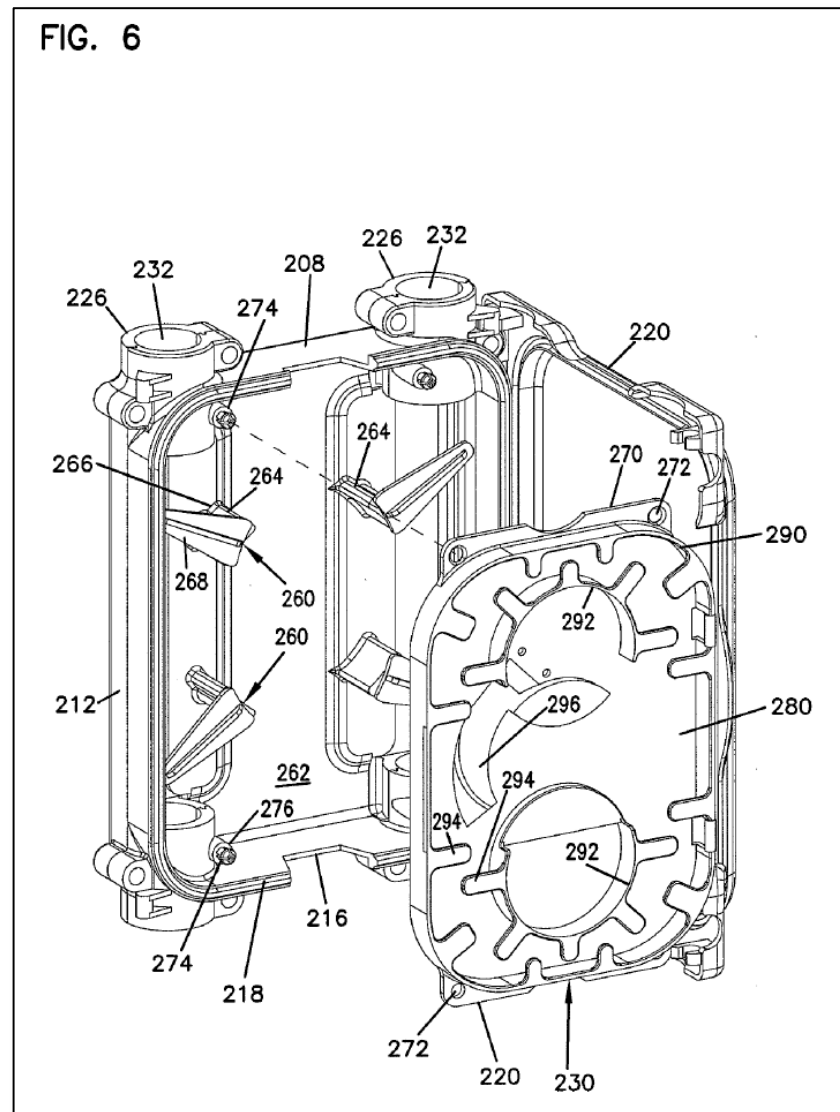
2. *Holmberg’s Teachings – Spools*

96. *Holmberg* teaches several spool structures. In one example, *Holmberg* teaches a single, solid circular spool. Spool structure 298 “includes an annular flange 302 located at the rear end of the spool structure 298. The annular flange 302 assists in retaining fibers spooled about the spool 300 from sliding off the end of the spool.” *Holmberg*, [0045]. *Holmberg’s* Fig. 7 depicts spool structure 298, annular flange 302, and spool 300.



Holmberg, Fig. 7.

97. In another example, *Holmberg* teaches four cable management members 260 that each include a bend radius limiter 264 and cable retention member 268. *Holmberg*, [0041]. A POSITA would have understood that the four cable management members 260 together function to provide cable wrapping functionality similar to a single spool, such as spool structure 298. Cable management members 260, bend radius limiters 264, and cable retention members 268 are depicted in Fig. 6 below.



Holmberg, Fig. 6.

98. In a third example, *Holmberg* uses two curved structures (e.g., half circles) as “partial” spools to store excess cable slack. For example, *Holmberg* teaches “[t]wo curved fiber storage walls 292 (e.g., partial spools) also project forwardly from the main panel 288. The fiber storage walls 292 have an outer curvature selected to provide bend radius protection to fibers routed about the

exterior of the fiber storage walls 292.” *Holmberg*, [0043]. *Holmberg* teaches that said partial spools are utilized to store excess cable fiber. *Holmberg*, [0043] (“In use, excess fiber can be looped around the fiber storage walls 292 so as to form an elongated fiber storage loop at the front side of the main panel 280.”), *id.* (“Fiber retention fingers 294 project inwardly from the perimeter wall 290 and outwardly from the fiber storage walls 292 and function to assist in retaining fibers within the area defined between the wall 290 and the walls 292.”). A POSITA would have understood that such “partial” spools are “partial” when compared to a single cylindrical spool. *See* Section V.C (where I opined regarding spools for storing cable slack).

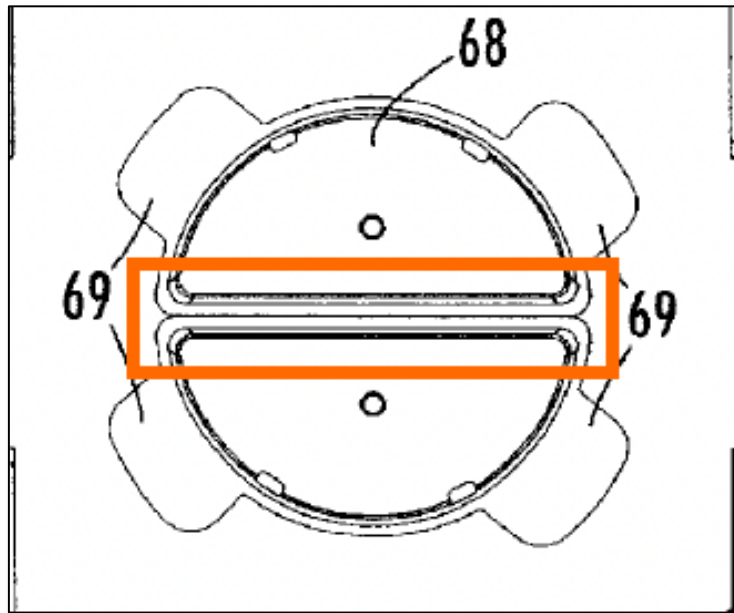
3. *Holmberg’s Terminated Fibers and First Spools*

99. Regarding the claimed feed break-out cables, I note that *Holmberg* teaches a jacketed cable that has the external jacket stripped (“drop cable”) and the internal optical fiber components/threads are separated into terminated fibers (the claimed “feed break-out cables”). For example, *Holmberg* teaches “selected fibers from the cable can be terminated (i.e., cut) adjacent one of the clamping portions 310 so as to provide a length of terminated fiber within the enclosure 202.” *Holmberg*, [0053]. Said terminated fibers are spooled using spool structure 298 for storage. *Holmberg*, [0053] (“The length of terminated fiber can be spooled around the spool structure 298 of the splice tray 230 for storage purposes.”). In my opinion,

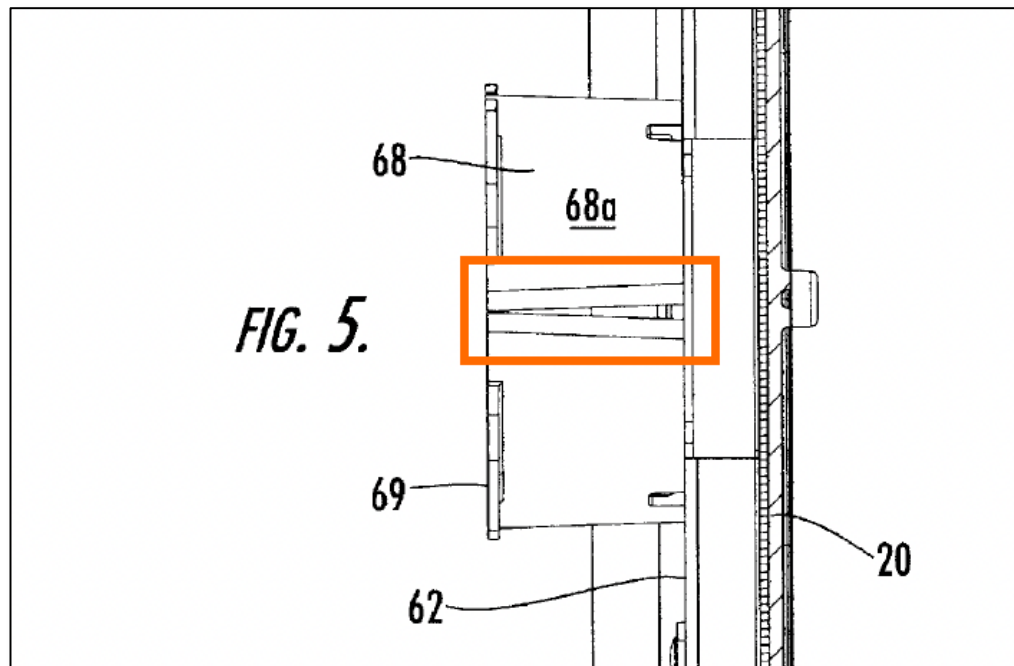
Holmberg teaches splicing terminated optical fibers to fibers of another cable, such as a distribution cable. *Holmberg*, [0053] (“When it is desired to splice one of the terminated fibers to a distribution cable, the terminated fiber can be accessed from the spool structure 298 and routed through one of the openings 296 in the splice tray 230 to the front side of the splice tray 230.”). Further, *Holmberg* teaches splicing a terminated fiber to a fiber of a distribution cable and mounting the splice in splice sleeve holder 294. *Holmberg*, [0053] (“At the front side of the splice tray, the terminated optical fiber can be spliced to a corresponding fiber of another cable (e.g., a distribution cable) with the splice being mounted at the splice sleeve holder 294 as shown at FIG. 12.”). As I opined above, spool structure 298 is located on the “back side” of main panel 288 of the splice tray 230. *Holmberg*, [0045]. Spool structure 298 also “includes a cylindrical spool 300 about which excess fiber can be wrapped.” *Id.*

100. Although spool structure 298 is depicted as a single circular spool structure, it would have been obvious to manufacture spool structure 298 (including spool 300) using two or more partial cylinders (curved structures), e.g., using two pieces such as taught by *Blankenship*. A POSITA would have understood that such a modification would have resulted in the same functionality for storing excess cable slack as *Holmberg*’s native one-piece spool. I note that manufacturing spool structures in separate pieces was well known in the art and was merely a

manufacturing design choice. In one example, *Blankenship* teaches such a two-piece cylinder design, where a cylinder routing guide 68 is formed from two semi-circular halves with a small gap in the middle of the two halves. The annotated excerpt of *Blankenship*'s Fig. 3 below depicts such a gap (annotated orange):



Blankenship, Fig. 3 (excerpt, annotated). *Blankenship*'s Fig. 5 depicts the gap from another point of view, in which the gap is triangular-shaped.



Blankenship, Fig. 5 (excerpt, annotated).

101. A POSITA would have been motivated and would have found it obvious to use two-piece construction for *Holmberg*'s spool structure 298 (including spool 300). Such a modification would have achieved additional weight reduction and cost savings by using less material to form spool structure 298. Further, a POSITA would have understood or at least found obvious that smaller molds would have been utilized to form two semi-circular² spool halves instead of a single, larger

² I note that "semi-circular" here should not be understood as limited to exactly 180 degrees but rather means a curved structure with an arc length sufficient to meet the minimum bend radius requirements of the optical fiber used.

spool, which would have advantageously achieved additional cost savings and improved ease of manufacturing spool structure 298. I also note that a POSITA would have been motivated to utilize two spool halves instead of a single circular spool structure to increase the amount of excess slack cable that could be stored around the spools. Indeed, by separating spool halves, additional cable slack may be stored compared to a single spool the same physical dimensions as the two spool halves. That is, separating spool halves creates additional distance over which cable slack may be stored and does not require utilizing additional material to create a larger spool to store additional cable slack. As noted above in ¶95, utilizing two semi-circular (partial) spool structures for *Holmberg's* spool structure 298 aligns with the use of the term “spools” in the '483 Patent.

102. I note that such a modification would not have required much additional space compared to utilizing a single spool structure (for example, in an arrangement taught by *Blankenship*) and thus *Holmberg's* spool structure 298 would have nested within bend radius limiters 264 without any issues. I note that to the extent a POSITA were motivated to modify *Holmberg's* spool structure 298 to accommodate additional cable slack for storage by increasing the distance between the two semi-circular halves, a POSITA would have understood or at least found obvious modifying *Holmberg's* cable management members 260 (including bend radius limiters 264) accordingly to accommodate a two-piece construction spool structure

298 to nest within said cable management members 260. For example, a POSITA would have been motivated and found it obvious to increase the space between cable management members 260 to accommodate a larger distance between two halves of a two-piece spool structure 298. Further, a POSITA would have had a reasonable expectation of success when modifying *Holmberg* for several reasons, including because utilizing two-piece construction techniques for spools was well known (as taught by *Blankenship*) and because such a modification would not have required extensive or complicated changes to implement.

103. In the alternative, a POSITA would have been motivated and found it obvious to replace *Holmberg*'s spool structure 298 with another of the spool designs expressly taught by *Holmberg*. As I discussed above, *Holmberg* teaches three different slack management spool structures: (1) a single circular spool (spool structure 298 including spool 300), (2) partial spools 292, and (3) cable management members 260 (where the four members function as a spool). A POSITA would have been motivated and found it obvious to replace the single spool structure 298 (including spool 300) with either of the other designs described by *Holmberg* or by duplicating spool structure 298 (including spool 300) to include two such spool structures 298 (including spools 300). Such modifications would have provided advantages to *Holmberg*'s wall box, including additional cable slack storage. Such a modification would have been a straightforward design choice that would have

been well within the skillset of a POSITA to implement and would have had the predictable result of allowing *Holmberg's* wall box to accommodate varying lengths of cable slack, including storing additional slack compared to a single circular spool. In my opinion, such a modification would have maximized cable slack storage for spool structure 298 (including spool 300) especially considering the physical size limitations of wall box 200. I note that such a modification would have been use of a known technique (using partial spools or two full spools instead of one full spool) and that such modification would have advantageously improved *Holmberg's* spool structure 298 to provide additional cable slack storage area. It is also my opinion that such a modification would have been merely simple substitution of well-known and common structural elements and the results of said modification would have been predictable (storing optical fiber cable slack).

104. Additionally, I note that it was known to use either a single or multiple structures (such as partial spools) to achieve the same result of storing cable slack while maintaining a particular minimum bend radius to prevent damage to fiber optic cable. *See* Section V. Indeed, during prosecution of the '483 Patent, both the US and foreign Examiners stated such. '483 *FH*, 184, 186, 233.

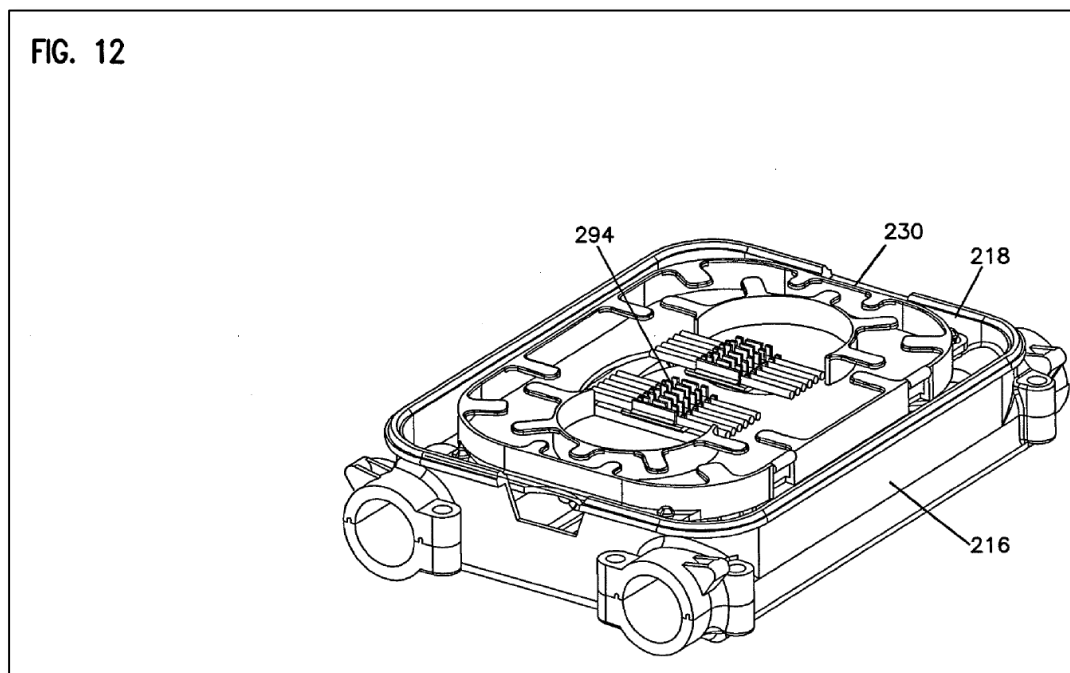
105. I note that a POSITA would have had a reasonable expectation of success when modifying *Holmberg* to utilize multiple structures to store cable slack. *Holmberg* already teaches a variety of cable retaining mechanisms (e.g., spool

structure 298, cable management members 260, partial spools 292). Therefore, in my opinion, *Holmberg* already teaches partial spools for storing excess cable slack, such that modifying *Holmberg* to utilize two partial or two full spools on the reverse side of splice tray 230 would have been using structures already present in *Holmberg*. While such a modification might require modifications to the size or spacing of certain components, a POSITA would have been motivated and would have understood how to modify *Holmberg* to accommodate such a modification to achieve the advantages I opined on above. In my opinion, such a modification would have had a reasonable expectation of success because managing such sizing or spacing aspects would have been well within the skillset of a POSITA.

4. *Plurality of Distribution Cables and Second Spools*

106. *Holmberg* teaches a plurality of terminated fibers and a plurality of corresponding fibers of distribution cables and also teaches splicing each terminated optical fiber to a corresponding fiber of a distribution cable. *Holmberg*, [0053] (“At the front side of the splice tray, the terminated optical fiber can be spliced to a corresponding fiber of another cable (e.g., a distribution cable) with the splice being mounted at the splice sleeve holder 294 as shown at FIG. 12.”). As I opined above, *Holmberg* teaches spooling terminated fiber around spool structure 298 for storage purposes and that “[w]hen it is desired to splice one of the terminated fibers to a distribution cable, the terminated fiber can be accessed from the spool structure 298

and routed through one of the openings 296 in the splice tray 230 to the front side of the splice tray 230.” *Holmberg*, [0053]. In particular, regarding a “plurality,” *Holmberg* teaches a plurality of terminated fibers. *Holmberg*, [0053] (“To access fibers within the wall box 200, selected fibers from the cable can be terminated (i.e., cut) adjacent one of the clamping portions 310 so as to provide a length of terminated fiber within the enclosure 202.”). A POSITA would have understood or at least found obvious from *Holmberg*’s teachings that a plurality of terminated fibers would have been spliced to a plurality of fibers of at least one distribution cable. For example, Fig. 12 below depicts a plurality of splices mounted at splice sleeve holder 294.



Holmberg, Fig. 12.

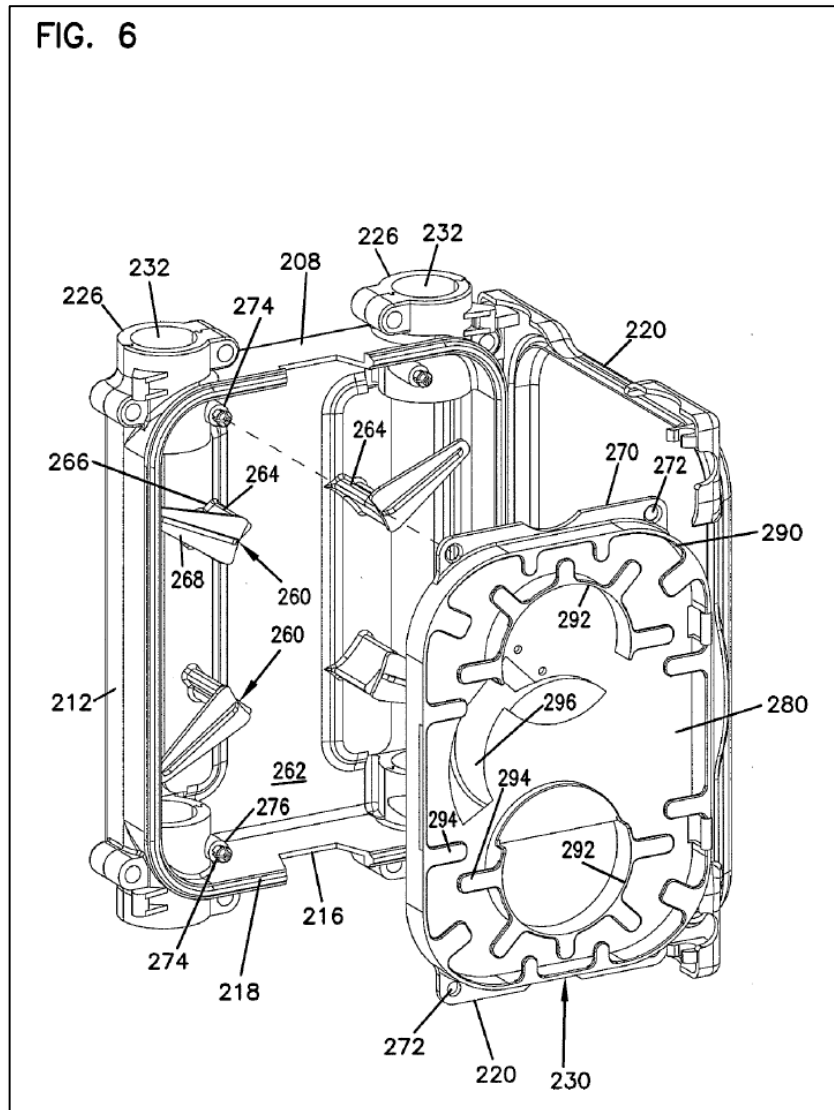
107. Further, I note that *Holmberg* teaches that distribution cables have a plurality of fibers that are then split into individual distribution fibers. *Holmberg*, [0005] (“The F1 portion of the network may include a distribution cable having on the order of 12 to 48 fibers; however, alternative implementations may include fewer or more fibers.”). Regarding splitting said distribution fibers into individual distribution fibers, *Holmberg* teaches that “a feeder cable having a number of fibers” may be split into “216 to 432 individual distribution fibers that may be associated with a like number of end user locations.” *Id.* It would have been obvious to a POSITA that *Holmberg*’s plurality of individual distribution cable fibers would have been spliced to a plurality of terminated fibers (“feed break-out cables”). Thus, in my opinion, *Holmberg* teaches “distribution cables coupleable to the plurality of feed break-out cables[.]” Indeed, the ’483 Patent describes “‘coupled’ and various thereof” as being “used broadly and encompass[ing] both direct and indirect mountings, connections, supports, and couplings. Further, ‘connect’ and ‘coupled’ are not restricted to physical or mechanical connections or couplings.” ’483 Patent, 2:67-3:5. Accordingly, a POSITA would have understood that *Holmberg*’s cables that are configured to be spliced together meets the claimed “coupleable.”

5. *Second Spools*

108. It is also my opinion that *Holmberg* teaches the claimed “second spools.” Specifically, I note that *Holmberg* teaches two “partial spools” (“two curved fiber storage walls 292”) on the “front” of splice tray 230 for storing excess fiber.

Two curved fiber storage walls 292 (e.g., partial spools) also project forwardly from the main panel 288. The fiber storage walls 292 have an outer curvature selected to provide bend radius protection to fibers routed about the exterior of the fiber storage walls 292. In use, excess fiber can be looped around the fiber storage walls 292 so as to form an elongated fiber storage loop at the front side of the main panel 280.

Holmberg, [0043], [0053] (“Excess fiber can be stored by wrapping the excess fiber around the fiber storage walls 292 at the front side of the splice tray 230.”). *Holmberg* teaches that fiber storage walls 292 also include fiber retention fingers 294 that “project inwardly from the perimeter wall 290 and outwardly from the fiber storage walls 292 and function to assist in retaining fibers within the area defined between the wall 290 and the walls 292.” *Holmberg*, [0043]. *Holmberg’s* Fig. 6 below depicts fiber storage walls 292 as part of splice tray 230:

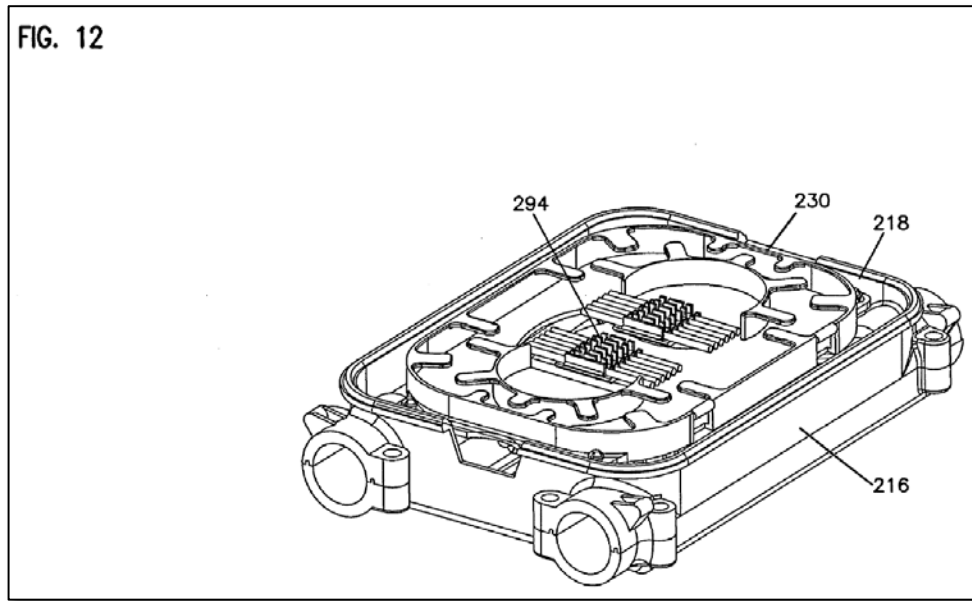


Holmberg, Fig. 6.

109. In my opinion, a POSITA would have understood or at least found obvious from *Holmberg*'s teachings that fiber storage walls 292 store excess slack from distribution cable fibers. *Holmberg* teaches terminated fiber slack is stored on spool structure 298, and said terminated fibers are routed to splice sleeve holders 294 where said terminated fibers are spliced to fibers of a distribution cable.

Holmberg, [0043]-[0044], [0052]-[0053]. Further, *Holmberg* teaches “[e]xcess fiber can be stored by wrapping the excess fiber around the fiber storage walls 292 at the front side of the splice tray 230.” *Holmberg*, [0053]. Thus, a POSITA would have understood or at least found obvious that the “[e]xcess fiber” stored on the fiber storage walls 292 would have been excess fiber from distribution cable fibers because terminated fiber slack is already stored on spool structure 298. *Holmberg*, [0043]-[0044], [0052]-[0053].

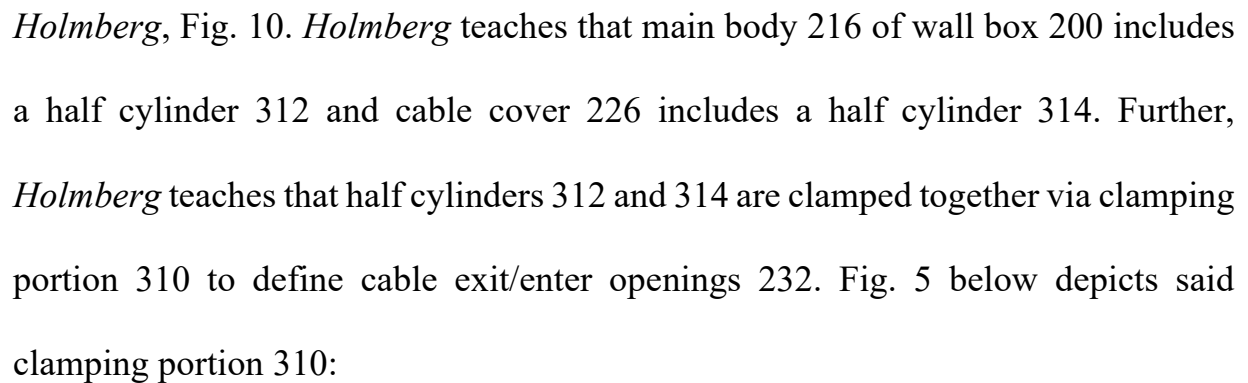
110. To the extent it is argued that *Holmberg* does not teach storing excess distribution cable fiber slack using fiber storage walls 292, a POSITA would have been motivated and found it obvious to use fiber storage walls 292 to store excess distribution cable fiber slack. Indeed, *Holmberg* already teaches a location for storing excess drop cable slack and terminated fiber slack (namely cable storage mechanisms 260 and spool structure 298, respectively). Thus, a POSITA would have been motivated to utilize fiber storage walls 292 to store excess distribution cable slack in the same way. *Holmberg*’s Fig. 12 below depicts splice sleeves 294, splice tray 230, and fiber storage walls 292:

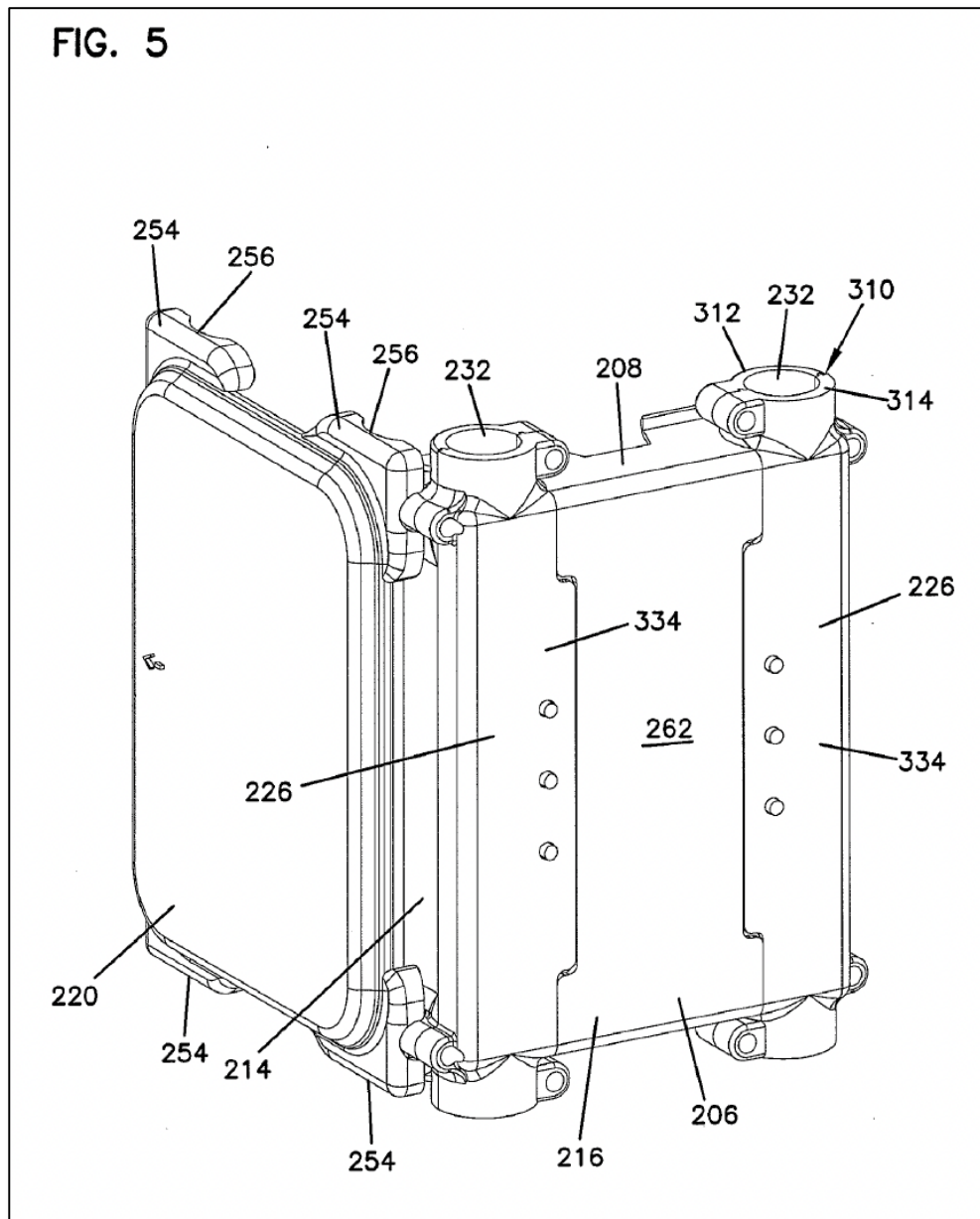


Holmberg, Fig. 12.

- F. Claim 11: “The drop interface box of claim 1, wherein the drop cable entrance further comprises slots formed in the base unit and configured to receive a cable clip which clips over the drop cable, the slots and the cable clip forming a substantially weather tight seal with the base unit.”**

111. As explained above, *Holmberg* teaches a drop cable. *See* Claim 1. Further, *Holmberg* teaches an entrance for a drop cable that comprises openings (“slots”) that are formed in main body 216 (“base unit”). For example, Fig. 10 below depicts cable exit/enter openings 232 for *Holmberg*’s drop cable to enter wall box 200 (specifically main body 216).

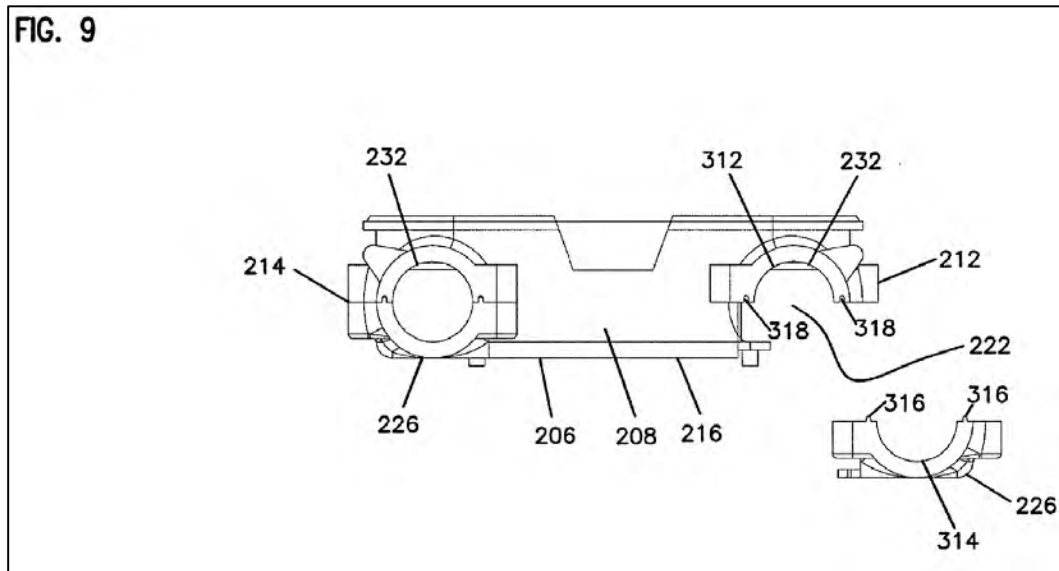




Holmberg, Fig. 5.

112. Specifically, regarding clamping portion 310, *Holmberg* teaches that each “cable clamping portion 310 is defined by a first half cylinder 312 integrally formed with the main body 216 and a second half cylinder 314 provided on one of the cable covers 226.” *Holmberg*, [0047]. I note that *Holmberg* also teaches main

body 216 includes slots 318 into which rails 316 of cable covers 226 fit so that half cylinder 312 and half cylinder 314 are properly aligned when clamped together. Fig. 9 of *Holmberg* below depicts the aforementioned half cylinders 312 and 314 as well as rails 316 and slots 318:



Holmberg, Fig. 9, [0047] (“Rails 316 provided at the second half cylinder 314 fit within corresponding slots 318 provided at the first half cylinder 312 to assist in maintaining alignment between the half cylinders 312, 314 during assembly and clamping.”); *see also Holmberg*, Figs. 8, 11.

113. A POSITA would have understood that *Holmberg’s* main body 216 includes half cylinder 312 and slots 318. It is also my opinion that a POSITA would have understood that *Holmberg’s* half cylinder 314 functions as a cable clip because half cylinder 314 clamps to half cylinder 312 (e.g., via clamping portion 310) and thus “provide[s] mechanical retention of the cable and also provide[s] a seal around

the perimeter of the cable jacket.” *Holmberg*, [0048]. In particular, *Holmberg* teaches cable clamping portions 310 can utilize “inserts” to “accommodate cables having different outer diameters[.]” *Holmberg*, [0048]. A POSITA would have understood that such inserts would have accommodated different diameter cables to provide a substantially weathertight seal. In particular regarding providing a seal, I note that *Holmberg* teaches using wall box 200 in either indoor or outdoor applications, such that a POSITA would have understood (or at least found obvious) that such a seal would have been a substantially weather tight seal to prevent water, rain, excessive moisture, dirt, or other such foreign objects from entering wall box 200 and causing damage to the fiber optic cables or other components within wall box 200. *Holmberg*, [0034].

XI. OPINIONS REGARDING GROUND 2: CLAIMS 2, 12, AND 13 ARE OBVIOUS OVER *HOLMBERG*, *BATTEY*, AND *BLANKENSHIP*

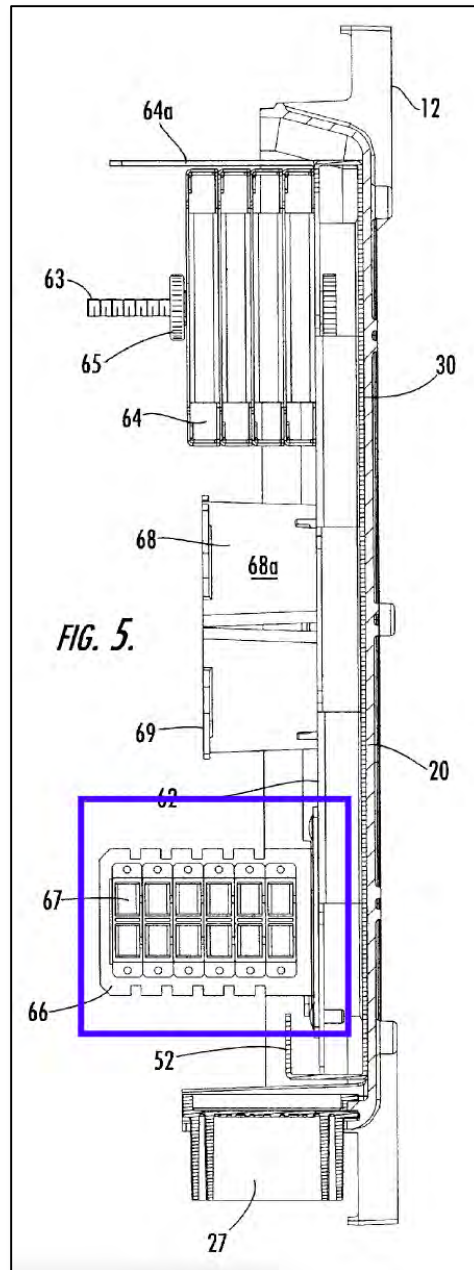
114. I note that for Ground 2 I have applied the same “second construction of ‘drop cable’” as I applied for Ground 1. *See* Section III.D; *see* Ground 1.

A. Claim 2: “The drop interface box of claim 1, wherein the fiber storage panel further includes an adapter bracket configured to hold one or more adapters which couple the plurality of feed break-out cables to the plurality of distribution cables.”

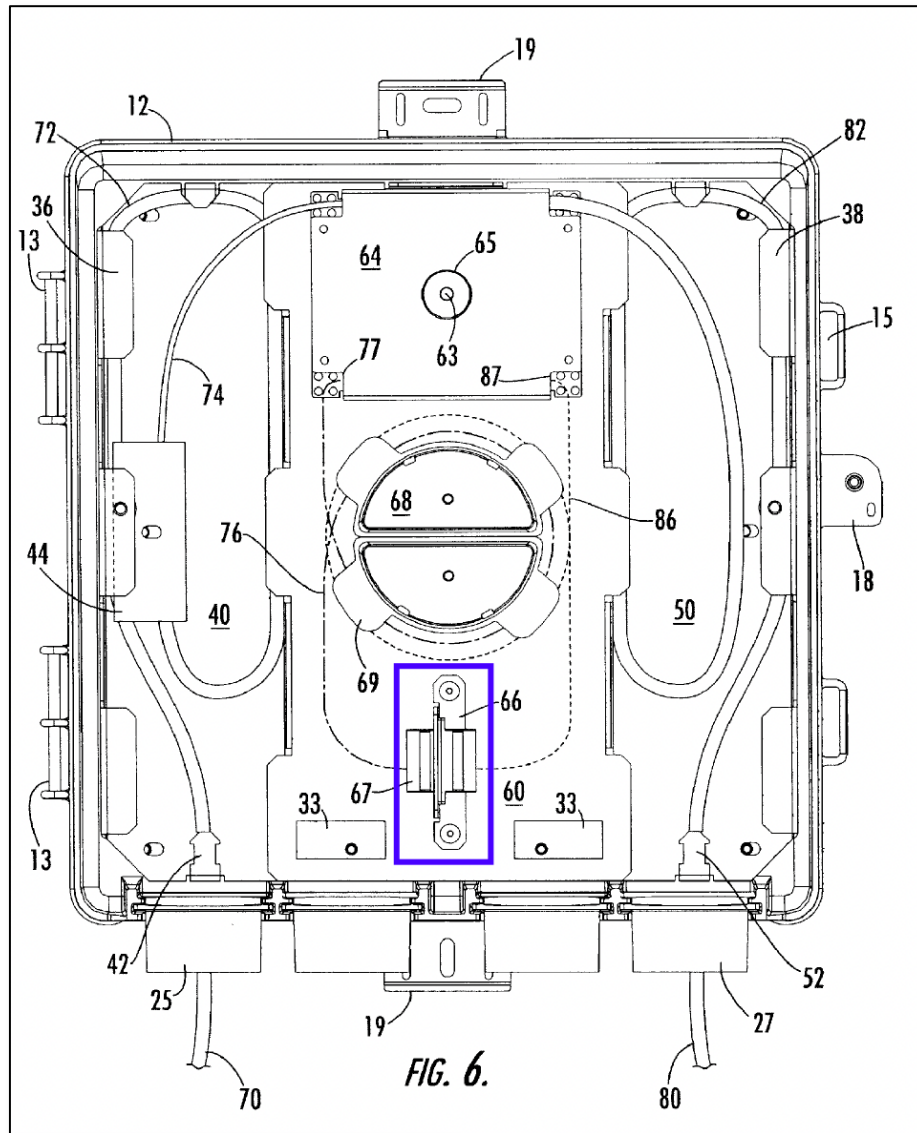
115. As discussed above, *Holmberg* in view of *Battey* renders obvious the claimed “fiber storage panel” and *Holmberg* teaches coupling a plurality of feed break-out cables to a plurality of distribution cables. *See* Ground 1, Claim 1.

116. I note that *Holmberg* does not expressly teach an adapter bracket that is configured to hold one or more adapters which couple a plurality of feed break-out cables to a plurality of distribution cables. However, this concept was known in the art, including as described by *Blankenship*. Specifically, *Blankenship* teaches a Network Interface Device (NID) 10 that includes a backplate 30 and a base 12. *Blankenship*, 3:33-49, 3:64-4:1, 4:19-39, 4:61-5:8, 5:26-32, 5:57-59, Figs. 4-6. A POSITA would have understood that *Blankenship*'s backplate 30 (or at least a portion thereof) functions as a fiber storage panel in the same manner as *Holmberg*'s splice tray 230. Specifically, *Blankenship* teaches backplate 30 includes a fiber connecting area 60, a platform 62 within fiber connecting area 60, and a connection tray 64 positioned on platform 62 of fiber connecting area 60. *Blankenship*, 3:44-46 (“[T]he backplate 30 defines ... a fiber connection area 60.”), 5:26-32 (“[B]ackplate 30 comprises a platform 62 located within the fiber connecting area 60 ... At least one connection tray 64 is positioned on the platform 62[.]”). *Blankenship* teaches connection tray 64 may be a conventional splice tray. For example, *Blankenship* teaches backplate 30 includes connection tray 64, which “may be any known device for joining optical fibers, for example a splice tray, a coupler tray, an adapter tray, a splice organizer, a splice holder, or the like. As shown, connection tray 64 is a conventional splice tray and a plurality of the connection trays 64 are secured on the platform 62 in stacked relationship.” *Blankenship*, 5:32-38.

117. In more detail, *Blankenship* teaches backplate 30 includes an adapter bracket 66 that is “for receiving the first connector and the second connector.” *Blankenship*, 5:46-6:27, 7:53-59, 8:1-6. *Blankenship* teaches that the first connector connects to “an optical fiber of the feeder cable from the first fiber management area 40” and that the second connector connects to “an optical fiber of the distribution cable from the second fiber management area 50.” *Id.* *Blankenship* teaches adapter bracket 66 includes a plurality of adapters 67 that “receiv[e] the first connector and the second connector in optical alignment to join the optical fiber of the feeder cable the optical fiber of the distribution cable.” *Blankenship*, 6:1-5. I have reproduced *Blankenship*’s annotated Fig. 5 below from the Petition, where annotated Fig. 5 depicts adapter bracket 66 and the plurality of adapters 67 (both in purple):



Blankenship, Fig. 5 (annotated). Similarly, I have reproduced annotated Fig. 6 below from the Petition, where annotated Fig. 6 depicts adapter bracket 66 and plurality of adapters 67 from a different perspective:



Blankenship, Fig. 6 (annotated), *see also* Figs. 2-4.

118. A POSITA would have been motivated and found it obvious to modify *Holmberg-Batthey* to include a plurality of brackets and an adapter bracket such as taught by *Blankenship* to couple a plurality of feed break-out cables to a plurality of distribution cables. Such a modification would have been use of a known technique of using adapters and an adapter bracket to advantageously improve *Holmberg-*

Battey in the same way these adapters benefit *Blankenship*, including by improving convenience and efficiency during installation. Indeed, such a modification would have provided simplified and robust optical connections between *Holmberg-Battey*'s terminated fibers ("feed break-out cables") and plurality of distribution cables using well-known adapters and adapter bracket.

119. Further, in my opinion, a POSITA would have had a reasonable expectation of success when making such a combination. Indeed, a POSITA would have understood that *Blankenship* is one example of prior art teaching that adapters and adapter brackets were well-known, well-understood devices for optically connecting various optical fibers. As such, a POSITA would also have understood that modifying *Holmberg-Battey* according to *Blankenship*'s teachings would have been straightforward and would not have required undue experimentation.

B. Claim 12: "The drop interface box of claim 11, and further comprising a strain-relief clamp coupled to the base unit proximate the drop cable entrance."

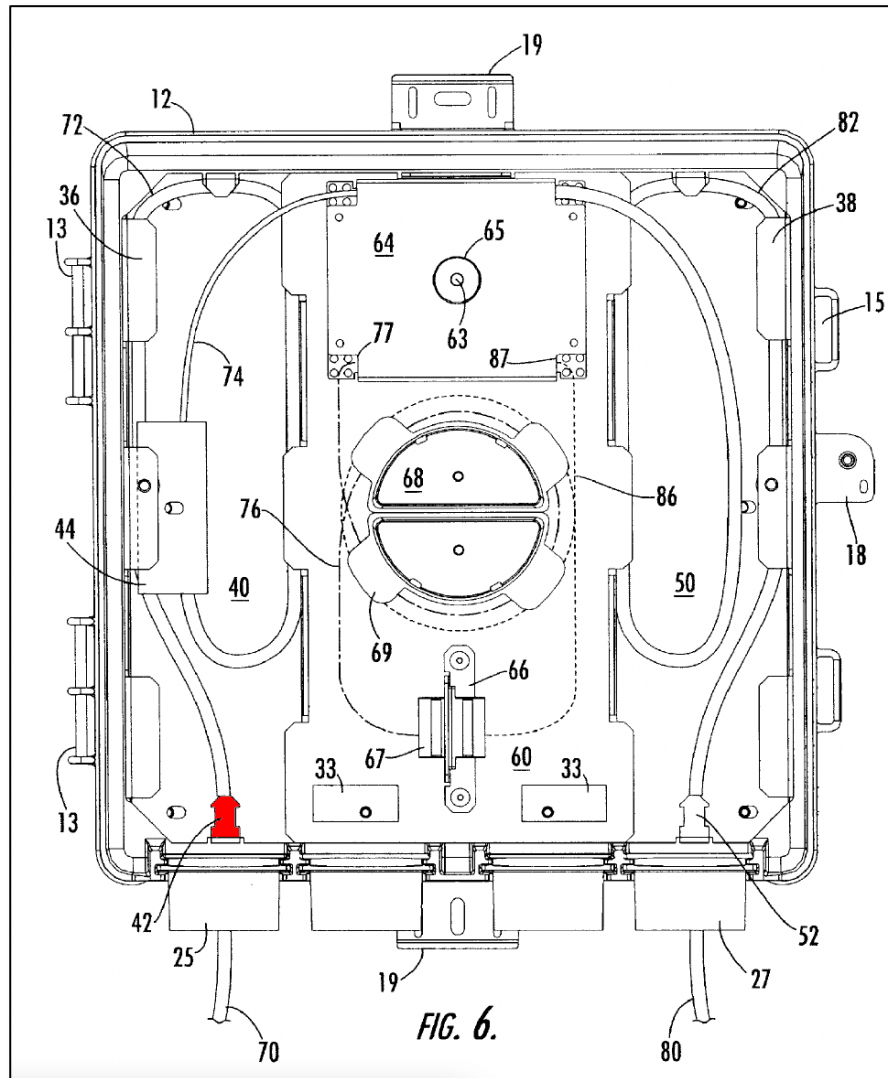
120. *Holmberg-Battey* teaches Claim 11. *See* Ground 1, Claim 11. Further, as discussed above, *Holmberg* teaches a main body 216 ("base unit") and a drop cable and drop cable entrance. *See* Ground 1, Claim 1.

121. *Blankenship* provides an express teaching of the claimed "strain-relief clamp." For example, *Blankenship* teaches a network interface device (NID) 10 and a feeder cable 70 that enters NID 10. *Blankenship*, 6:40-42 ("The feeder cable 70

enters the first fiber management area 40 of NID 10 through first port 25.”).

Blankenship further teaches that “the feeder cable 70 is st[r]ain³ relieved at strain relief bracket 42[.]” *Blankenship*, 6:42-43, 4:28-35. I have reproduced annotated Fig. 6 from the Petition below, where *Blankenship*’s strain relief bracket 42 (red) is depicted proximate the entrance of the feeder cable 70 that enters NID 10.

³ A POSITA would have understood that “stain” is a typographical error that should read “strain.” *Blankenship*, 6:42-43. Indeed, *Blankenship* teaches “strain relief bracket 42” for strain relieving feeder cable 70. *Id.* I note that *Blankenship* teaches strain relief numerous times. *See Blankenship*, 4:28-35 (including teaching “the feeder cable may be strain relieved as it enters the first fiber management area 40” and “strain relief bracket 42 for strain relieving the feeder cable with a clamping device[.]”), 4:58-65. *Blankenship* makes the same typographical error describing “stain” (strain) relieving distribution cable 80 using strain relief bracket 52. *Blankenship*, 7:25-27.



Blankenship, Fig. 6 (annotated).

122. In my opinion, a POSITA would have been motivated and would have found it obvious to modify *Holmberg-Batthey* in view of *Blankenship*'s teachings to include a strain relief bracket to advantageously provide strain relief for a drop cable proximate to a drop cable entrance of a NID (such as *Holmberg*'s wall box 200). Indeed, strain relief for optical fiber cables was a well-known and important feature in such boxes, and *Blankenship* is merely one example of this concept. A POSITA

would have been motivated to use such a known technique of utilizing a strain relief bracket to advantageously improve *Holmberg-Battey* in the same way it benefits *Blankenship*, providing strain relief to a drop cable entering a wall box/NID. Further, such a modification would have been combining prior art elements such as a strain relief bracket with a NID or wall box according to known methods as taught by *Blankenship* and would have yielded the predictable result of providing strain relief for a drop cable entering said NID/wall box, such as taught by *Blankenship*. Indeed, a POSITA would have known and understood the importance of protecting optical fiber cables from sharp bends or from exceeding a minimum bend radius and that sources of strain would have damaged optical fiber cables. Therefore, a POSITA would have been motivated and found it obvious to modify *Holmberg-Battey* to include a strain relief bracket to similarly protect a drop cable entering *Holmberg-Battey's* wall box 200.

123. A POSITA would also have understood or would have at least found obvious that modifying *Holmberg-Battey* according to *Blankenship's* teachings to include a strain relief bracket/clamping device that said strain relief bracket/clamping device also would have been coupled to the main body ("base unit") of *Holmberg*. I note that *Holmberg* does not expressly teach a "backplate" like *Blankenship's* backplate 30. Additionally, *Holmberg* teaches a drop cable enters wall box 200 and main body 216 via cable opening 232 instead of via splice tray 230.

However, a POSITA would have found it obvious to modify *Holmberg-Batthey* according to *Blankenship's* teachings such that a strain relief bracket or similar clamping device in *Holmberg-Batthey* would have been coupled to main body 216 (“base unit”) to thus provide strain relief for a drop cable entering main body 216. Indeed, a POSITA would have understood or at least found it obvious that a strain relief bracket or clamping device would have been secured to main body 216 for stability and to thus provide strain relief to a cable entering main body 216 via cable opening 232. Coupling a strain relief bracket to main body 216 would thus have provided such stability and would have advantageously provided strain relief for *Holmberg-Batthey's* drop cable in the same way as strain relief is provided for *Blankenship's* feeder cable.

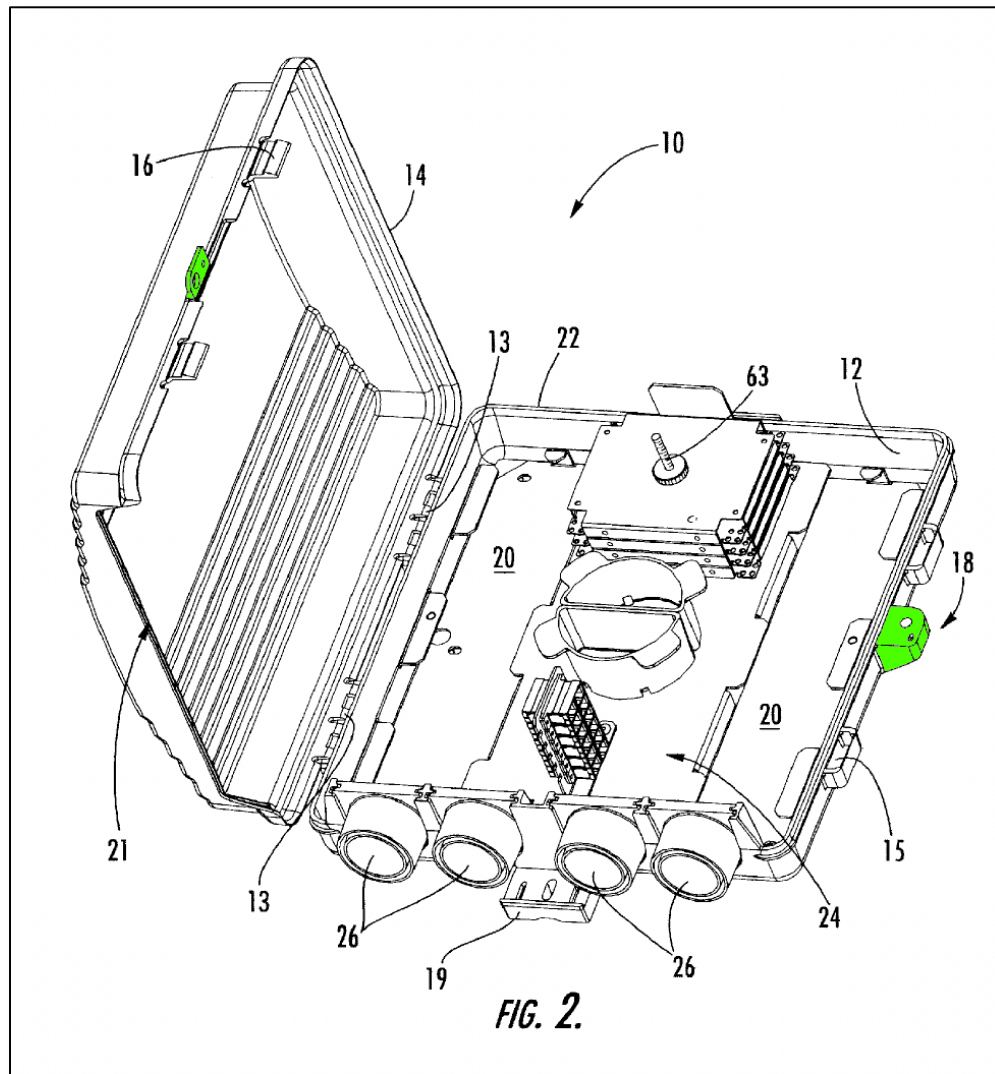
124. Such a modification to *Holmberg-Batthey* in view of *Blankenship's* teachings would have had a reasonable expectation of success. I note that strain relief brackets or similar clamping devices were well-known, well-understood, and widely utilized devices for providing strain relief to optical fiber cables, with *Blankenship* teaching one example. Modifying *Holmberg-Batthey* to include a strain relief bracket or similar clamping device thus would not have required undue experimentation and would have been a straightforward modification well within the skillset of a POSITA to implement.

C. Claim 13: “The drop interface box of claim 1, and further comprising a security mechanism for securing the cover to the base unit in a closed position.”

125. *Holmberg-Batley* teaches Claim 1. *See* Claim 1.

126. *Blankenship* also expressly teaches security mechanisms that secure cover 14 to base 12. Specifically, *Blankenship* teaches security means 18 for locking cover 14 to base 12. In one example, means 18 comprises a locking screw 17. *Blankenship*, 2:50-54 (“[M]eans 18 opposite the hinges 13 for locking the cover 14 on the base 12. For example, means 18 may comprise a locking screw 17 that requires an industry specific tool to remove.”). In another example, *Blankenship* teaches means 18 comprises aligned openings for a combination or key lock. *Blankenship*, 2:54-57 (“Alternatively, means 18 may comprise aligned openings through the base 12 and the cover 14 that receive a combination or key lock (not shown) belonging to the subscriber.”). In yet another example, *Blankenship* teaches locking cover 14 to base 12 to “prevent unauthorized access.” *Blankenship*, 2:61-65 (“Alternatively, the NID 10 may be mounted outside the subscriber premises and the cover 14 locked on the base 12, as described hereinabove, to prevent unauthorized access to the optical components and connections housed within the NID 10.”). Therefore, in my opinion, a POSITA would have understood that *Blankenship*’s means 18 would have been a security mechanism for securing the cover to the base unit in a closed position, as claimed. I have reproduced annotated Fig. 2 from the

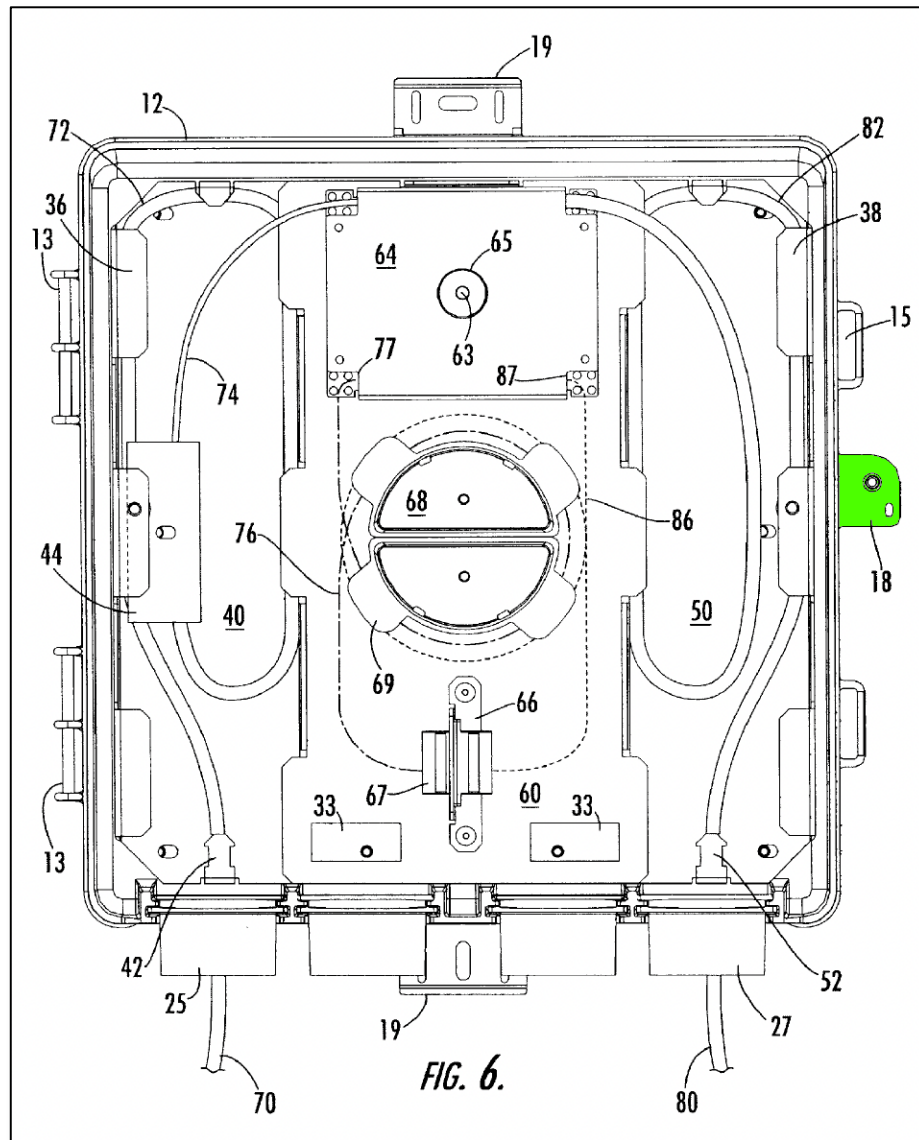
Petition below, which depicts *Blankenship's* NID 10 as well as means 18 (annotated green) and a corresponding (but not numbered) tab with aligned holes (also annotated green) for securing cover 14 to base 12.



Blankenship, Fig. 2 (annotated).

127. A POSITA would have understood or would have at least found obvious that *Blankenship's* means 18 would have functioned with the annotated “tab” portion of cover 14 to secure said cover 14 to base 12. For example, as I opined

above, *Blankenship* teaches aligned holes of means 18 for securing cover 14 to base 12. I have also reproduced annotated Fig. 6 from the Petition below. Annotated Fig. 6 depicts means 18 (green) from another perspective:



Blankenship, Fig. 6 (annotated), see also Figs. 1, 3.

128. A POSITA would also have been motivated and found it obvious to modify *Holmberg-Batthey* in view of *Blankenship*'s teachings of means 18 to secure

Holmberg's cover 220 to main body 216. Such a modification would have been the use of a known technique of utilizing a securing means such as those taught by *Blankenship* (for example, locking screw, combination lock, or a key lock) with the result of advantageously providing security for *Holmberg-Batley's* wall box 200 by securing the cover to the main body in a closed position in the same way. It is also my opinion that such a modification would have combined prior art elements such as securing means, a base, and a cover according to known methods with the predictable result of a cover secured to a base unit, such as taught by *Blankenship*. Indeed, a POSITA would have been motivated to make such a modification to *Holmberg-Batley* to improve security for the wall box and to advantageously “prevent unauthorized access to the optical components and connections housed within,” as *Blankenship* expressly teaches. I note that *Holmberg* teaches both indoor and outdoor applications for wall box 200, such that a POSITA would have been motivated to provide security to prevent tampering or unauthorized access to wall box 200 for safety and to prevent damage to components therein. For example, securing the cover to the base unit would have helped prevent unauthorized access, tampering, or accidental openings and subsequent damage due to storms, high winds, or other such environmental factors.

129. Modifying *Holmberg-Batley* according to *Blankenship's* teachings would have had a reasonable expectation of success. Securing devices such as locks

and fasteners were well known in the prior art, and *Blankenship* teaches examples of such securing devices to secure a cover to a base unit of a NID. In my opinion, modifying *Holmberg-Batley's* wall box 200 to include security means such as taught by *Blankenship* would have been straightforward and required only minor changes to accomplish. Such a modification would not have required undue experimentation and would not have added significant cost to wall box 200. Indeed, even if such a modification caused an increase in cost, a POSITA would have appreciated that the tradeoff of slightly higher up front cost to add security means to a wall box in exchange for additional security would have been worthwhile. Specifically, a POSITA would have recognized that unauthorized tampering or damage caused by environmental forces (e.g., storms) would have associated costs for repairs (including materials, technician time and pay) and disadvantages (including service downtime, dissatisfied subscribers, loss of subscribers) that likely would cost more than simply adding security means (locking screw, combination or key lock) to prevent such damage in the first place.

XII. OPINIONS REGARDING GROUND 3: CLAIMS 1-2, 11-13 ARE OBVIOUS OVER *HOLMBERG, BATTEY, AND BLANKENSHIP*

130. For Ground 3, I have applied the “first construction” of “drop cable”—a construction that requires the drop cable retain its external jacket as its routed inside the box. *See* Section III.D. In my opinion, a POSITA would have been motivated and found it obvious to modify *Holmberg-Batley* according to

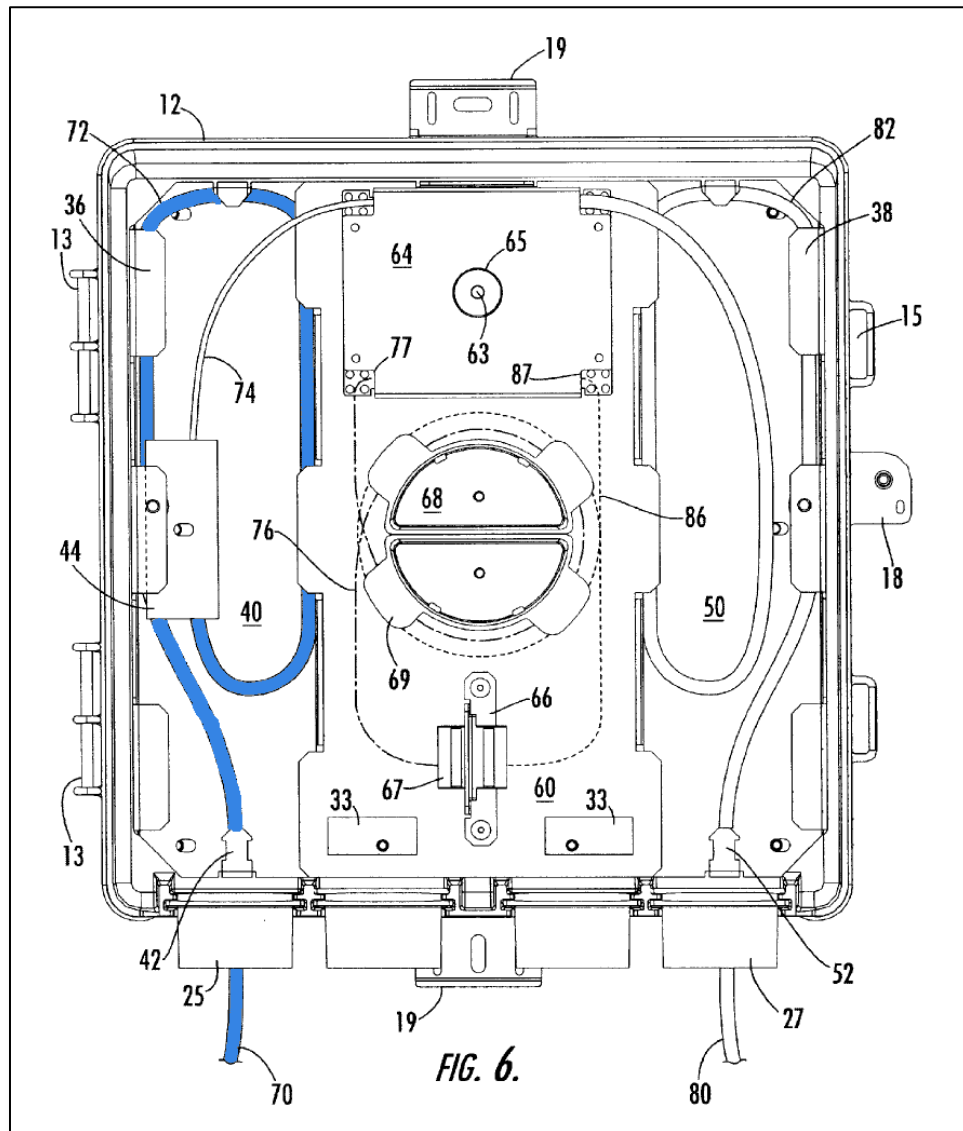
Blankenship's teachings to store a length of jacketed drop cable in a drop interface box. *See* Ground 3, Claim 1.

- A. **Claim 1(Pre): “A drop interface box configured to be mounted to a structure and to receive a drop cable from an optical fiber service provider distribution point and a plurality of distribution cables which distribute the optical fiber service, the drop interface box comprising:”**

131. As discussed above, *Holmberg* teaches a wall box 200 that is configured to be mounted to a wall or pole (“structure”), and a POSITA would have found it obvious that *Holmberg*'s jacketed cable is from the claimed “an optical fiber service provider distribution point.” *See* Ground 1, Claim 1. Further, *Holmberg* teaches a “plurality of distribution cables which distribution the optical fiber service” as claimed. *See* Ground 1, Claim 1.

132. *Blankenship* teaches a Network Interface Device (NID) 10 that includes a feeder cable 70. *Blankenship*, 6:28-35. *Blankenship* teaches feeder cable 70 is “a drop cable from a fiber optic closure, remote terminal, or other local access point in an optical network” and that feeder cable 70 “comprises a relatively flexible jacket made of a weatherproof material, such as plastic, for protecting at least one, and preferably at least a pair, of optical fibers.” *Blankenship*, 6:28-40, 8:1-6. I have reproduced annotated Fig. 6 from the Petition below, where *Blankenship*'s feeder cable (annotated blue) is depicted as entering NID 10 and a length of feeder cable 70 is stored using retaining flanges 36 “that project into the first fiber management

area 40 for retaining slack lengths of the feeder cable and/or optical fiber of the feeder cable.” *Blankenship*, 4:35-39.



Blankenship, Fig. 6 (annotated), 6:28-56 (including teaching “As shown, a slack length 72 of feeder cable 70 is routed within the first fiber management area 40 in a clockwise direction under the retaining flanges 36.”). As I opine below, it would

have been obvious to a POSITA to modify *Holmberg* in view of *Blankenship*. See Claim 1(a).

- B. Claim 1(a): “a base unit having a drop cable entrance configured to receive the drop cable and having drop cable retaining mechanisms spaced apart and configured to retain a length of drop cable looped around the drop cable retaining mechanisms;”**

1. *Holmberg’s Teachings*

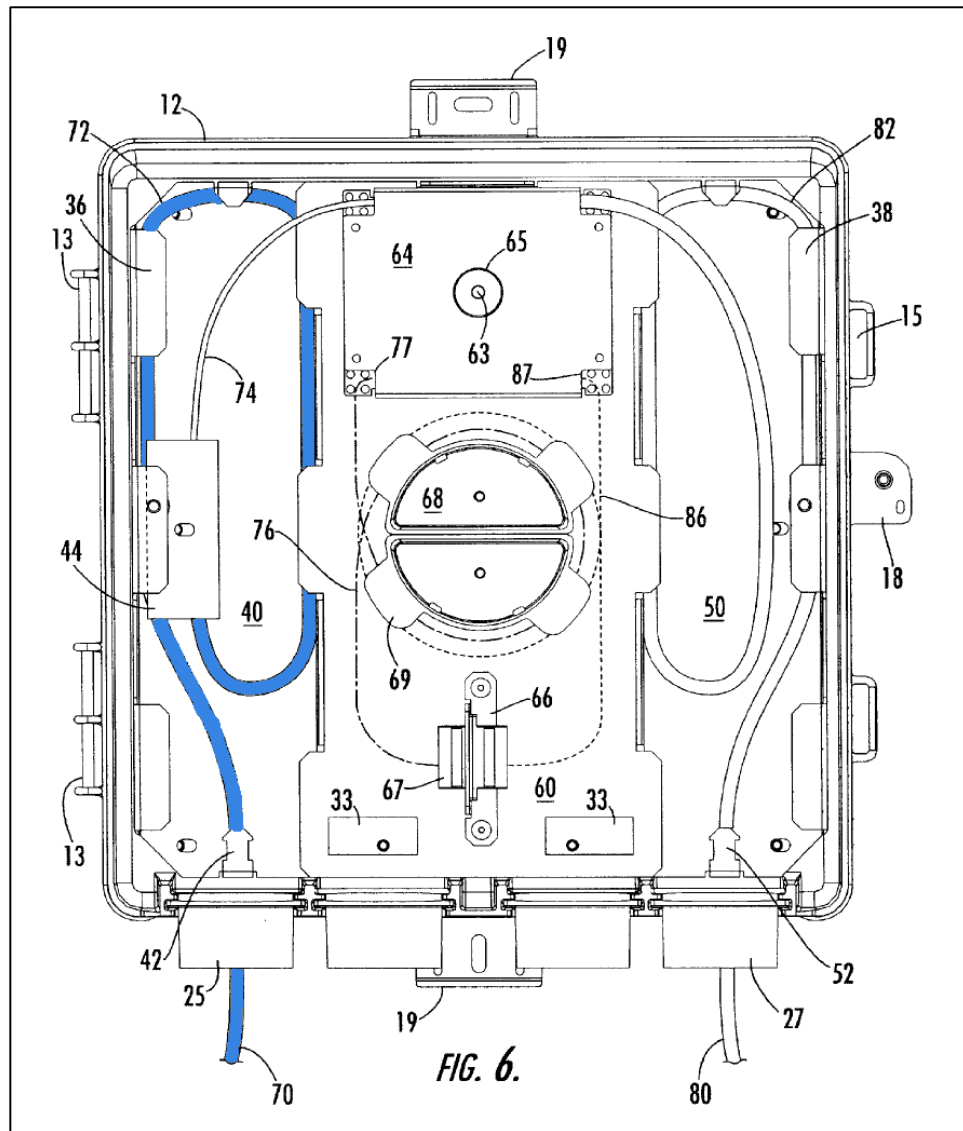
133. *Holmberg* teaches a wall box 200 that has a main body (“base unit”) and cable exit/enter openings 232 that are formed from half cylinders 312 and 314 where at least one of openings 232 is an entrance for a drop cable. See Ground 1, Claim 1(Pre), Claim 1(a). I note that *Holmberg* teaches said cable exit/enter openings 232 allow “the portions of the telecommunications cable located upstream and downstream of the mid-span access location to enter and exit the enclosure 202.” *Holmberg*, [0037], [0046]-[0048], [0052]-[0054], Figs. 3-10. *Holmberg* also teaches wall box 200 receives a jacketed cable and includes cable management members 260 and bend radius limiters 264 that retain a length of cable looped around said retaining mechanisms. *Holmberg*, [0052]-[0053]; see Ground 1, Claim 1. However, *Holmberg* teaches stripping the outer jacket from the jacketed cable inside of wall box 200 rather than storing a length of cable with its exterior jacket inside of wall box 200. *Holmberg*, [0052]-[0053]; see Ground 1, Claim 1.

2. *Blankenship’s Teachings*

134. *Blankenship* teaches a Network Interface Device (NID) 10 that is similar to *Holmberg's* wall box 200, but retains the external jacket on its drop cable as that drop cable is routed inside the NID. For example, NID 10 “provides access to the optical connections for installation, reconfiguration and test operations” and is configured to be mounted “to a wall or other building structure” and further includes a base and a cover that pivots between open and closed positions. *Blankenship*, 1:7-11, 1:14-53 (generally), 2:32-46, 2:57-60. *Blankenship* teaches that NID 10 has a base 12 and that a slack length 72 of feeder cable 70 is stored within said base 12. *Blankenship*, 4:32-36, 6:28-56, Fig. 6. In particular, *Blankenship* teaches “[a]s shown, a slack length 72 of feeder cable 70 is routed within the first fiber management area 40 in a clockwise direction under the retaining flanges 36.” *Blankenship*, 6:28-56. *Blankenship* teaches feeder cable 70 “comprises a relatively flexible jacket made of a weatherproof material, such as plastic, for protecting at least one, and preferably at least a pair, of optical fibers.” *Blankenship*, 6:35-40, 8:1-6. Thus, in contrast to *Holmberg's* cable where the exterior jacket is stripped inside wall box 200, *Blankenship* teaches feeder cable 70 comprises a weatherproof jacket and a length of such jacketed cable is stored within NID 10. *Blankenship*, 6:35-40, 8:1-6; *see* Ground 1, Claim 1.

135. I have reproduced annotated Fig. 6 from the Petition below, where *Blankenship's* feeder cable (annotated blue) is depicted as entering NID 10 and a

slack length 72 of feeder cable 70 is stored using retaining flanges 36 “that project into the first fiber management area 40 for retaining slack lengths of the feeder cable and/or optical fiber of the feeder cable.” *Blankenship*, 4:35-39.



Blankenship, Fig. 6 (annotated), 6:28-56.

3. Motivation to Combine Holmberg and Blankenship

136. A POSITA would have been motivated and found it obvious to modify *Holmberg* in view of *Blankenship* to retain the external jacket on the drop cable as that drop cable is routed within wall box 200. Such a modification would have been use of a known technique to store excess length of the externally jacketed cable within a NID in light of *Blankenship's* teachings to advantageously improve *Holmberg* in the same way as *Blankenship*. For example, such a modification would have advantageously stored extra length of cable slack for when such is needed and further such a modification would have reduced the length of cable jacket to be stripped by a field technician. Indeed, a POSITA would have understood that it was advantageous to provide flexibility to field technicians to utilize externally jacketed cables and pre-connectorized drop cables or to utilize cables that are stripped and spliced within a wall box/NID. Modifying *Holmberg* according to *Blankenship's* teachings would have provided such flexibility, and fiber optic network providers would have benefited from such flexibility and potentially expanded client base by having more options for implementing fiber optic enclosures at businesses, multi-dwelling units, or other locations.

137. Further, I note that it was well known in the prior art that mid-span access enclosures were compatible with pre-connectorized drop cables. A POSITA would have been familiar with such and would have understood that such is one of the scenarios that *Holmberg-Batthey-Blankenship* accommodates. For example, as I

opined above, *Cooke* teaches such an arrangement, including a fiber optic distribution cable and pre-connectorized mid-span access locations. *See* Section V.D.

138. It is also my opinion that *Holmberg's* wall box design is not limited to a mid-span access design but would also accommodate a terminating access setup. Terminating access (e.g., a box at which the drop cable is terminated completely) is a configuration in which a pre-connectorized and jacketed drop cable is commonly utilized. A POSITA would have understood that *Holmberg's* wall box would have been easily re-configured for terminating access by plugging/capping cable egress openings 232 so the drop cable would not "pass through" the wall box, but would instead enter the box through ingress openings 232 and terminate fully when coupled to feed break-out cables. Accordingly, a POSITA would have understood or would have at least found obvious that *Holmberg's* wall box accommodates both mid-span and terminating scenarios such that the same box is used in series for all access scenarios between the service provider and customers. Using the same wall box for both mid-span and terminating access configurations would have been advantageous by creating manufacturing and installation efficiencies instead of requiring separately manufactured and installed boxes for mid-span and terminating access configurations.

139. Modifying *Holmberg* according to *Blankenship*'s teachings would have had a reasonable expectation of success. Indeed, both *Holmberg* and *Blankenship* teach similar fiber optic enclosure devices (i.e., *Holmberg*'s wall box 200 and *Blankenship*'s NID 10) that store optical cables and both store cable slack. Indeed, storing excess drop cable in an enclosure was well known, with both *Blankenship* and *Bloodworth* teaching storing excess drop cable in an enclosure. See Section V (where I opined regarding *Bloodworth*'s teachings). Further, *Holmberg* already includes structures for storing excess drop cable slack, namely, cable management members 260 that include bend radius limiters 264 and cable retention members 268. *Holmberg*, [0041], [0044], [0052]-[0053]. While modifying *Holmberg* to store externally jacketed cable may have required changing the dimensions or placement of cable management members 260 to accommodate a particular minimum bend radius for jacketed drop cable instead of stripped cable, such a modification would have been well within the skillset of a POSITA. Indeed, modifying *Holmberg* in light of *Blankenship*'s teachings would have been straightforward and would not have required undue experimentation, and a POSITA would have had a reasonable expectation of success when making such a modification.

C. Claim 1(b): “a cover having a hinged connection to the base unit to selectively enclose a storage area provided in the base unit; and”

140. See Ground 1, Claim 1(b).

- D. Claim 1(c): “a fiber storage panel having a hinged connection to the base unit on a side opposite the hinged connection of the cover to the base unit such that the fiber storage panel is moveable relative to the base unit and configured to be stored between the base unit and the cover,”**

141. *See* Ground 1, Claim 1(c).

- E. Claim 1(d): “the fiber storage panel having first spools positioned to store a plurality of feed break-out cables coupleable to the drop cable, the fiber storage panel further having second spools positioned to store a plurality of distribution cables coupleable to the plurality of feed break-out cables.”**

142. As I discussed above, *Holmberg-Blankenship* teaches the “first construction” of “drop cable.” *See* Ground 3, Claims 1(Pre), 1(a); *see* Section III.D.

143. As I also discussed above, *Holmberg-Batthey* teaches a “fiber storage panel,” as well as the claimed “first spools” and “second spools.” *See* Ground 1, Claim 1(d).

- F. Claim 2: “The drop interface box of claim 1, wherein the fiber storage panel further includes an adapter bracket configured to hold one or more adapters which couple the plurality of feed break-out cables to the plurality of distribution cables.”**

144. *See* Ground 3, Claim 1; Ground 2, Claim 2.

- G. Claim 11: “The drop interface box of claim 1, wherein the drop cable entrance further comprises slots formed in the base unit and configured to receive a cable clip which clips over the drop cable, the slots and the cable clip forming a substantially weather tight seal with the base unit.”**

145. *See* Ground 1, Claims 1, 10, 11; Ground 3, Claim 1.

- H. Claim 12: “The drop interface box of claim 11, and further comprising a strain-relief clamp coupled to the base unit proximate the drop cable entrance.”**

146. See Ground 1, Claim 11; Ground 2, Claim 12.

- I. Claim 13: “The drop interface box of claim 1, and further comprising a security mechanism for securing the cover to the base unit in a closed position.”**

147. In my opinion, *Holmberg-Batthey-Blankenship* teaches Claim 1. See Ground 3, Claim 1 and Ground 2, Claim 13.

XIII. OPINIONS REGARDING GROUND 4: CLAIM 10 IS OBVIOUS OVER HOLMBERG, BATTEY, AND COWEN

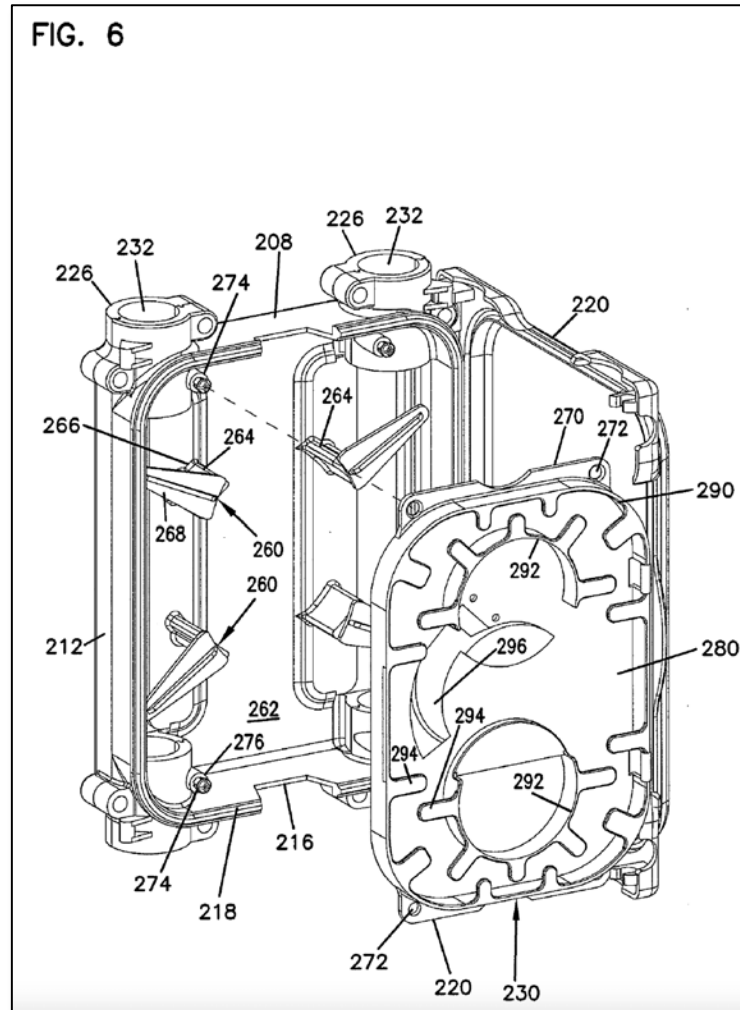
148. I note that for Ground 4 I have applied the same “second construction of ‘drop cable’” as I applied for Ground 1. See Section III.D; see Ground 1.

- A. Claim 10: “The drop interface box of claim 1, wherein the drop cable retaining mechanisms in the base unit comprise storage clips positioned on opposing sides of the base unit.”**

1. *Holmberg’s Teachings*

149. *Holmberg-Batthey* teaches Claim 1. See Ground 1, Claim 1. As discussed above, *Holmberg* teaches four cable management members 260 that are integrally formed with back wall 262 of main body 216 of wall box 200. *Holmberg*, [0041]. *Holmberg’s* drop cable enters main body 216 is excess slack is wrapped around cable management members 260, which also include bend radius limiters 264 and cable retention members 268. *Holmberg*, [0041], [0045], [0052]. Regarding the claimed

positioning “on opposing sides of the base unit,” *Holmberg*’s cable management members 260 are depicted as being located on opposing sides of main body 216.

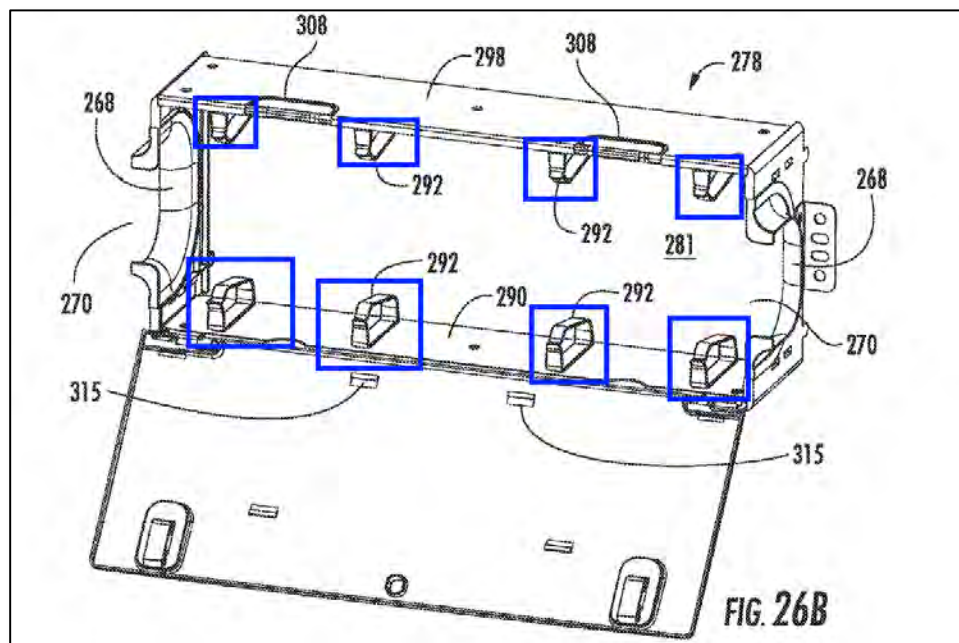


Holmberg, Fig. 6, Fig. 10.

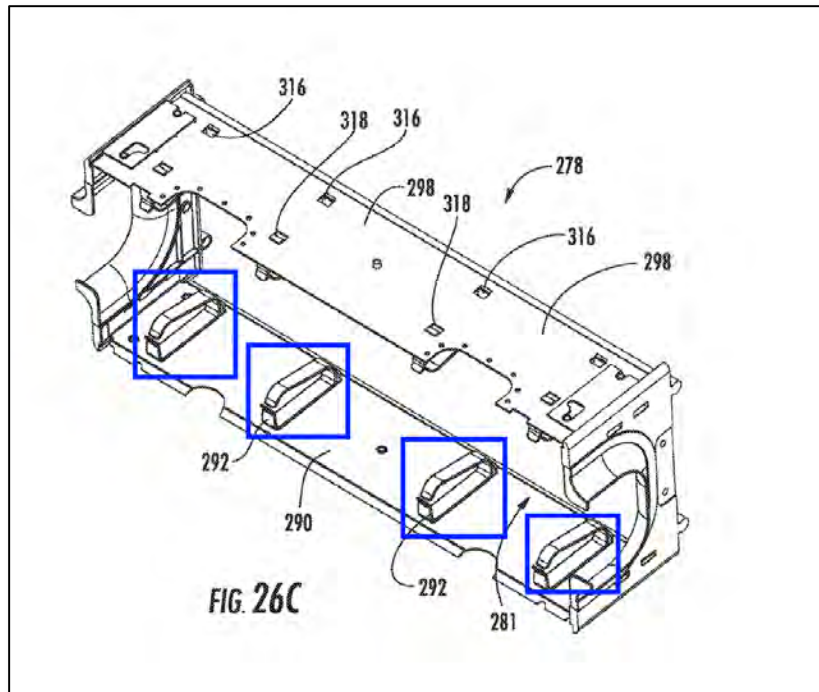
2. *Cowen*’s Teachings

150. *Cowen* teaches “storage clips,” as claimed. In particular, *Cowen* teaches clips 292 that are fully enclosed and fiber optic cables are routed through said clips 292. Clips 292 are “used for routing control and management of fiber optic cables

and optical fibers,” which “may be routed through one or more of the plurality of clips 292[.]” *Cowen*, 27:41-50. I note that *Cowen* teaches clips 292 are attached to panels of a fiber optic enclosure via a hook 318 and a corresponding receiver 316. *Cowen*, 27:57-28:7. I have reproduced annotated Fig. 26B from the Petition below, where *Cowen* teaches a plurality of clips 292 (annotated blue) attached to panels of a fiber optic enclosure.

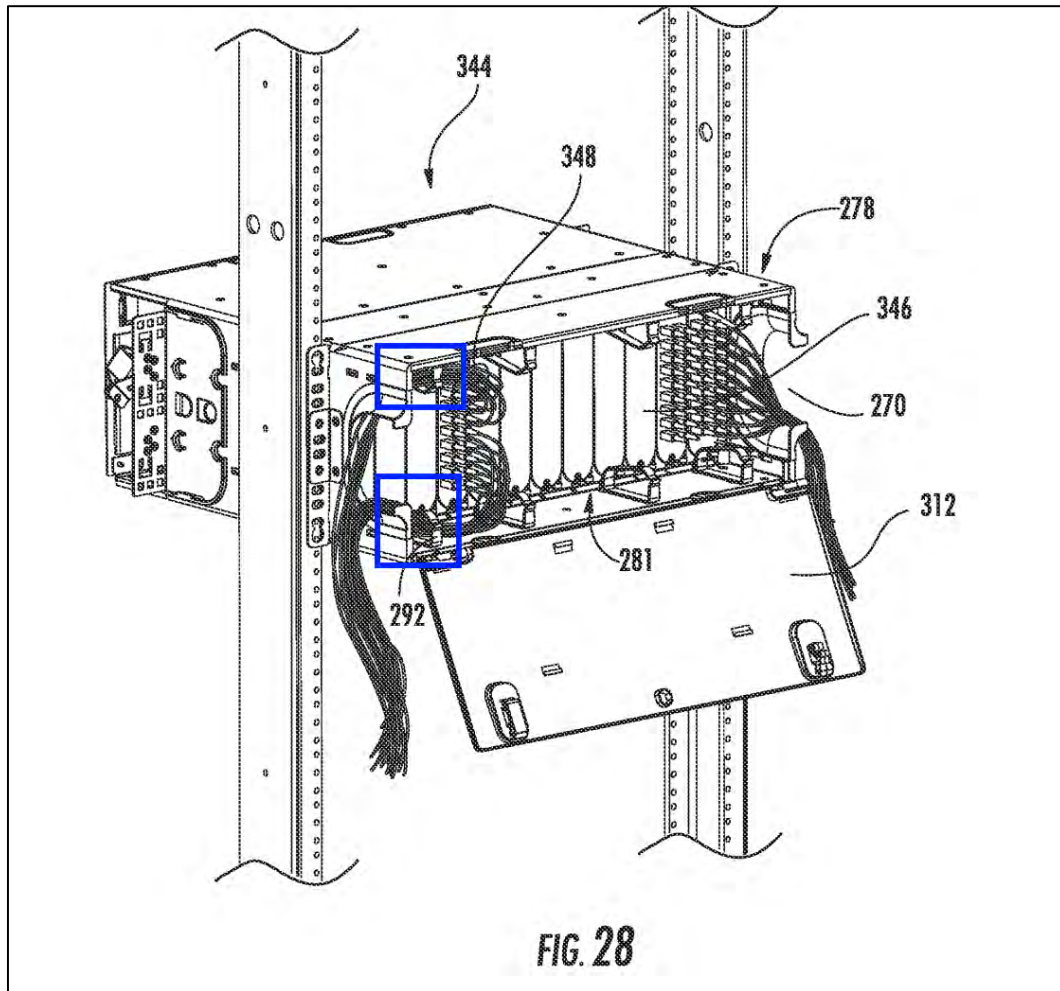


Cowen, Fig. 26B (annotated). *Cowen* also teaches another perspective of clips 292 as depicted in annotated Fig. 26C below, which I have also reproduced from the Petition.



Cowen, Fig. 26C (annotated). I note that the clips 292 attached to the top panel are less visible in Fig. 26C than in Fig. 26B.

151. *Cowen* also teaches utilizing clips 292 to route and manage fiber optic cables, as depicted in Fig. 28, which I have reproduced from the Petition below. Clips 292 (annotated blue) are located on the bottom and top panels below, and fiber optic cables are routed through clips 292.

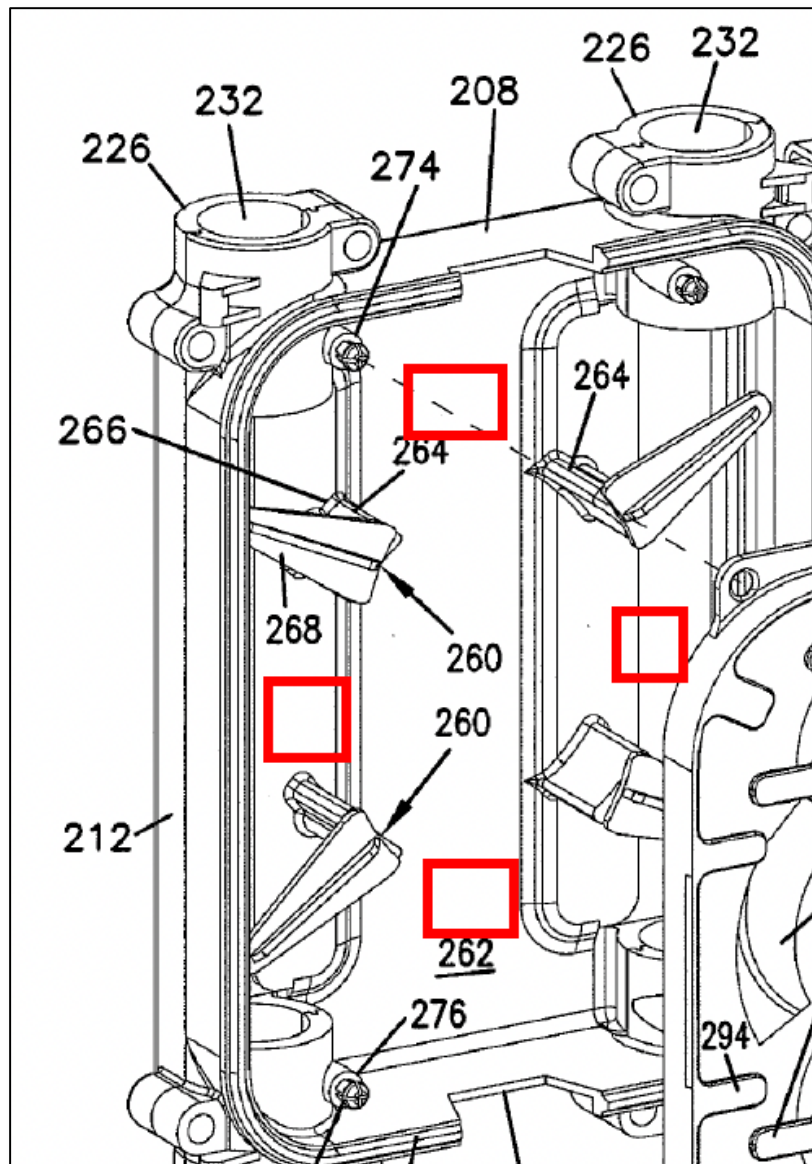


Cowen, Fig. 28 (annotated).

3. Motivation to Combine Holmberg-Battey and Cowen

152. A POSITA would have been motivated and found it obvious to modify *Holmberg-Battey* (or *Holmberg-Battey-Blankenship*. See Grounds 3, 5) in view of *Cowen* to advantageously use storage clips for fiber optic cable routing control and management. Indeed, such a modification would have advantageously improved fiber optic cable routing control and management for *Holmberg's* drop cable. I note that while *Holmberg* already includes cable management members 260, *Cowen's*

clips 292 fully enclose fiber optic cables, which would have improved cable routing and management in *Holmberg-Battey's* fiber optic wall box. A POSITA would have modified the *Holmberg* combination by supplementing or replacing *Holmberg's* cable management members 260 to utilize a plurality of *Cowen's* clips. For example, *Cowen* teaches using eight such clips. *See* Figs. 26B, 26C, 28 (reproduced above). A POSITA would have been motivated and found it obvious to locate said clips on opposing sides of main body 216 based on cable bend radius requirements and cable management or routing needs. For example, replacing cable management members with clips located would have improved cable management and routing compared to the existing cable management members 260 by fully encompassing the fibers being routed. Similarly, supplementing cable management members 260 by adding storage clips at distance(s) away from cable management members 260 or between members 260 would have added additional routing locations for *Holmberg's* drop cable. Both modifications would have improved *Holmberg's* product flexibility by providing more cable routing and management options. A POSITA would have understood or at least found obvious that such distance(s) for placing clips would have been determined based on a minimum bend radius of the cable(s) to be routed through said clips. As an example, I have annotated *Holmberg's* Fig. 6 below to illustrate exemplary locations for placing clips 292 at distance(s) away from cable management members 260.



Holmberg, Fig. 6 (annotated).

153. I note that the distances in the annotations above are not intended to be to scale, but rather the annotations are to illustrate exemplary locations for adding clips to *Holmberg-Batthey's* main body 216. A POSITA would have understood or at least found obvious that one such advantageous configuration would have been to modify *Holmberg-Batthey* to include a plurality of clips on opposing sides of main

body 216 to improve cable routing and management and to help *Holmberg's* drop cable to maintain the minimum bend radius. Further, a POSITA would have understood that *Cowen's* clips fully encompass the cable fibers, which provides for improved security including during installation. Indeed, when replacing *Holmberg's* cable management members 260 with *Cowen's* clips, a POSITA would have understood that the result would have advantageously included fully retaining fibers even when fibers are not wrapped tightly around a full retaining mechanism. Whether supplementing *Holmberg's* cable management members 260 or replacing such, a POSITA would have understood or found obvious to attach clips to the back panel, such as is done for cable management members 260 (*Holmberg*, [0041] teaching cable management members are integrally formed with a back wall 262 of main body 216), or to attach clips to the sides of main body 216, and that either configuration would have resulted in advantageous cable routing and management.

154. A POSITA would have understood that when modifying *Holmberg-Battey* to either supplement or replace *Holmberg's* cable management members 260, including a plurality of such clips would have been combining prior art elements (e.g., clips, main body, cable management members, drop cable) according to known methods (as taught by *Cowen*) to yield the predictable result of improved cable management and routing, per *Cowen's* teachings. A POSITA would further have understood that such a use of known technique of utilizing clips through which fiber

optic cables are routed in a fiber optic enclosure would have advantageously improved *Holmberg-Battey* in the same way as *Cowen* by improving *Holmberg-Battey*'s cable routing and management.

155. Such a modification would have had a reasonable expectation of success. A POSITA would have understood that such clips would have been readily available, off-the-shelf components. I note that *Cowen* teaches providing hooks 318 and receivers 316, such that a POSITA would have understood from *Cowen*'s teachings how to modify *Holmberg-Battey* to include said clips in a plurality of locations in main body 216, such as on opposing sides as I opined above. Indeed, a POSITA would have understood or at least found obvious that modifying *Holmberg-Battey* according to *Cowen*'s teachings would have been straightforward and would not have required undue experimentation. Further, using such clips was well known in the prior art, with *Cowen* teaching one example. Therefore, in my opinion, a POSITA would have appreciated a reasonable expectation of success when modifying *Holmberg-Battey*, and such a modification would not have required undue experimentation but rather would have been a straightforward modification well within the skillset of a POSITA.

XIV. OPINIONS REGARDING GROUND 5: CLAIM 10 IS OBVIOUS OVER *HOLMBERG, BATTEY, BLANKENSHIP, AND COWEN*

156. I note that for Ground 5 I have applied the same "first construction of 'drop cable'" as I applied for Ground 3. *See* Section III.D.

A. Claim 10: “The drop interface box of claim 1, wherein the drop cable retaining mechanisms in the base unit comprise storage clips positioned on opposing sides of the base unit.”

157. *Holmberg-Batthey-Blankenship* teaches Claim 1. *See* Ground 3, Claim 1. Further, as I opined in the prior section, *Cowen* teaches the claimed storage clips positioned on opposing sides of the base unit. *See* Ground 4, Claim 10. In my opinion, a POSITA would have been motivated and found it obvious to modify *Holmberg-Batthey-Blankenship* according to *Cowen*’s teachings of using clips for cable routing and management for the same reasons I provided above. *See* Ground 4, Claim 10. Further, in my opinion, a POSITA would have been motivated and found it obvious to modify *Holmberg-Batthey-Blankenship* to supplement or replace *Holmberg*’s cable management members 260 and to utilize clips for cable routing and management for a drop cable that retains its external jacket as the drop cable is routed internally (*see* Ground 3), and that the advantages I opined on above for Ground 4, Claim 10 apply equally when the external jacket of the drop cable is retained (*see* Ground 3) and when the external jacket is removed as the drop cable enters the wall box (*see* Grounds 1, 2, 4).

Declaration of Dr. Sayfe Kiaei
Patent No. 9,008,483

XV. CONCLUSION

158. I hereby declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct, and that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true. I understand that willful false statements are punishable by fine or imprisonment or both. *See* 18 U.S.C. § 1001. If called to testify as to the truth of the matters stated herein, I could and would testify competently.

Date: 9-12-2023

Respectfully submitted:



By:

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Sayfe Kiaei

Professor, Motorola Endowed Chair Professor

School of Electrical, Computer and Energy Engineering, Arizona State University, Tempe, AZ

FIELDS OF SPECIALIZATION

- **Integrated Circuits (IC):** Analog & Digital IC, Mixed-Signal IC, VLSI, Processor, ASIC, RFIC
- **Radio Frequency:** RF, Receiver, Transmitter, Synthesizer, Antenna, MIMO, RF system
- **Power Management:** Power Management IC, Battery Management, Energy System, Energy Management
- **Sensors:** RFID, ZIGBEE, BT, Custom Sensors, MICS, IOT, Bioelectronics, Bio-sensors, Hearing Aid sensors, Implanted devices electronics
- **Bio-Electronics:** Bio-Sensors, Hearing Aid, Implanted Bio-Electronics, Medical Implanted Communication System (MICS)
- **Signal Processing:** Digital Signal Processing, Adaptive Signal Processing, Video & Audio Signal Processing, Adaptive Audio Array processing, Audio and Acoustic & Speech processing
- **Wireless Communication Systems:** 1G-5G, 2-way radio, BT, WIFI, Sensors, ZIGBEE, wireless sensors
- **Wireline Communication System:** CABLE, DSL, Optical
- **Digital System:** VLSI, Processor, DSP processor

DEGREES

- **Ph.D.,** Electrical and Computer Engineering, Washington State University, 1987
- **M.S.,** Electrical and Computer Engineering, Washington State University, 1984
- **B.S.E.E.,** Electrical Engineering, Northeastern University, Washington State University, 1982

ACADEMIC POSITIONS

Fall 2001-Present: Professor, Motorola Endowed Chair Professor in Analog and RFIC School of Electrical, Computer and Energy Engineering, Arizona State University, Tempe, AZ

- **Professor:** Research and teaching in integrated circuits, RF circuits and systems, Communications, Wireless and Wireline transceiver, mixed-signal and Analog IC, Sensors, Power management IC, Signal processing, Bio-electronics, Signal Processing, Audio processing, GPS, wireless system
- **Research Projects:**
 - Analog and digital IC, Radio Frequency IC, RF transceiver
 - VLSI, Processor System Architecture, ASIC
 - Power Management IC, Battery Management & Sensing, Integrated Power Electronics
 - Digital Signal Processing, Audio processing, adaptive signal processing, Array processing, AI
 - Wireless communication system, wireless modems, 1G, 2G GSM, 3G CDMA, 4G LTE, 5G wireless mobile system, LTE, WiFi, Bluetooth, Wireless system standards
 - Wireline Communication system and transceivers, MODEM standards, CABLE MODEM DOCS, DSL

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- Signal Processing, Digital Signal Processing, Adaptive Signal Processing
- Adaptive Audio Array processing, Audio and Acoustic & Speech processing,
- Sensors, Bio-electronics, Bio-sensors, Hearing Aid Electronics, Implanted devices electronics
- Research Funded by NSF, USAID, DARPA, JPL, NASA, Motorola Inc., Intel Inc., Broadcom, Qualcomm, Raytheon, General Dynamics, Texas Instruments, and over 10 other industries. List of Current significant research awards:
 - Center of Excellence for Energy (COE) in Egypt , Funding \$22.5M
 - Partnership Center for Energy systems, USAID, 2015-2020, \$18M. Principle Investigator
 - Solar Energy Development in ME, Private funds and World Bank, \$2M
 - Connection One NSF Center, Director, 2004-Present, Total funding \$5M, average annual funding over \$750K.

2021-Present, Director, USAID, Center of Excellence for Energy (COE) in Egypt , Funding \$22.5M

- Director and PI: COE - Energy Center funded by the USAID.
 - USIAD Centers of Excellence for Energy (COE) - established the Center of Excellence for Energy (COE/E) in Egypt with funding and support from the United States Agency for International Development (USAID/Egypt) in November 2021. COE/E is a partnership between ASU-US and three Egyptian partner universities (EPU): Ain Shams University (ASU-EG), Aswan University (AU), and Mansoura University (MU).

2004-Present, Director and founder of NSF IUCRC Center Connection One, School of Electrical, Computer, and Energy Engineering, Arizona State University, Tempe, AZ; <https://connectionone.org>

- The NSF Connection One Industry/University Cooperative Research Center was established the center in 2002 with focus on communication system, integrated Circuits and Systems, wireless system, RF, sensors, and related areas. The center has five university member with over 30 industrial members. Total funding over \$10M.

2014-2020, Director, USAID, US-PCASE: Center for Advance Studies in Energy, Funding \$18M.

<https://uspcase.asu.edu/>

- **Director and PI:** PCASE - Partnership Center for Energy systems, Energy Center funded by the USAID.
- USIAD Centers for Advanced Studies in Energy program (USPCAS-E) is a partnership between Arizona State University and two leading Pakistani universities: the National University of Science and Technology (NUST) Islamabad and the University of Engineering and Technology in Peshawar (UET).
- PCASE has developed two new Graduate schools of Energy. Within 5 years, the center has over 1000 MS and PHD Students, with 14 new energy degrees in MS and PhD, two new building with 20+ energy labs in the power system, grid, power electronics, renewable energy, PV, Wind, Hydro, bio-fuel, fuel cell, batteries and storage, and thermal areas.

2008-2012: Associate Dean of Research, Ira A. Fulton Schools of Engineering, Arizona State University

Responsible for leading the research infrastructure, promoting and developing research programs with industry and federal agencies, leading large multi-university proposals, investing and providing seed funding to foster new

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research areas, and promoting graduate program in the college of engineering. Research Enterprise support included:

- Increase College of Engineering research funding from \$50M to over \$80M.
- Working with Vice President for Research, Dean's, and directors on University-wide research initiatives.
- Established the first NSF Engineering Research Center (ERC) at the ASU on Solar Energy QESST. Managed, organized and planned the ERC proposal process. ASU is the lead school partnering with MIT, Georgia Tech, U of Delaware, Cal-Tech, U of New Mexico, and UA.
- Lead several trans-disciplinary 4M research projects (4M: multi-million, multi-investigator, multi-disciplinary, multi-university grants) in energy, security, and related initiatives.
- Oversight of over 20 existing research centers in the college of Engineering.
- Engage with industry and federal government to establish new research collaborations.
- Organized workshops and supported proposals for NSF, NIH, DOE, DOD, DARPA, etc.
- Organized workshops for new assistant professors to apply for NSF CAREER Awards. ASU CAREER awards grew from 3 annual awards in 2008 to over 15 CAREER awards by 2012.
- Research Administration and pre-award proposal administration for the schools. Developed a decentralized research administration and advancement team for the Schools supporting 5 schools, 12 departments, over 220 engineering faculty, with funding over \$70M.
- Annual budget over \$7M for supporting research centers, seed funding for new center, cost sharing, proposal support, equipment and infrastructure support, graduate scholarships, and research administration.
- ADR Staffs included, Director of industrial and government liaison, Director of research administration, and 14 research advancement staff.
- Graduate Programs: Recruiting, Fellowships, marketing, outreach, coordination with departments

1997-2001, Adjunct Professor, Electrical and Computer Engineering Dept., The University of Texas, Austin, Texas, Taught graduate courses at UT Austin on Introduction to Telecommunication System and Digital Communications. Co-advised two Ph.D. program committees in IC design and Telecomm (while at Motorola)

1987-1993, NSF Center For Digital / Analog IC (CDADIC) Co-Director, NSF IUCRC Center director at Oregon State University. The CDADIC was established the center in 1987 with focus on integrated circuits at WSU, UW, and OSU with over 20 industrial members - <https://cdadic.oregonstate.edu/>

1987-1993, Assistant / Associate Professor (Tenured) Electrical and Computer Engineering Department, Oregon State University, Corvallis, OR

- Research and classes in Electronics, DSP, Communication system and networks, Wireless systems, MODEMS. Graduated 30 MS and Ph.D. students.
- Faculty Chair, Computer Engineering Program, Developed a new Computer Engineering Program at OSU in 1987

INDUSTRIAL POSITIONS

1993-2001: Motorola Inc., Senior Member of Technical Staff, Personal Communication Sector, Austin, Texas - Worked projects related to wireless communications, two way radios, wireless networks, ADSL and MODEM RF, and related areas.

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- **Motorola Cellular Division, Wireless Technology Center (WITC), 1997-2002.** Responsible for development of integrated circuits and systems for wireless handset. Lead number of projects including cellular (2G, 3G, 4G), wireless connectivity (Bluetooth and WIFI transceiver), GPS and location Receiver, wireless networks, 2-way radios and related areas. Worked on the development of various subcomponents including system design, link budget, RF front-end, RF receiver, RF transmitter, digital audio processing, audio processing, DSP, frequency synthesizer, ADC, DAC, filtering, analog front-end, power management, battery management, and baseband processor, baseband circuits and systems.
- **Motorola Semi-conductor products sector (SPS), Broadband Products Operations, 1995-1997,** Worked on the development of XDSL (ADSL, VDSL, G.lite), MODEM, and Optical broadband communication systems including OFDM, modulation, synchronization, equalization and the development of a single chip ADSL transceiver (*CopperGold™*). The transceiver contained Analog Front End (A/D, D/A, Hybrid), custom DSP, baseband processor, DMT, modulation/demodulation, FFT, IFFT, echo canceler, time domain equalizer, front-end constellation mapping, Trellis code modulation, Viterbi decoder), audio processing, DSP, signal processing, and an on-chip DSP core.
- **Land Mobile Products Sector LMPS 1993-1995,** Responsible for Wireless digital two-way radios, developed RFIC, RF receiver, RF transmitter, digital audio processing, audio custom IC, DSP, frequency synthesizer, ADC, DAC, hot spot wireless network, next generation of digital two-way radios, "*Talk about Radios*", Japanese cellular systems (PHS).
- **Standards,** Represented Motorola in various standards including 2G-4G, GPS, Bluetooth working group, WiFi, 802.11, and DSL standards including T1E1, International Telecommunication Unit (ITU), T1E1, ETSI, 3GPPP, Universal ADSL Working Group (UAWG), Bluetooth working group, G.Lite working group, etc.
- **University relations,** Responsible for the development of collaborative research programs with several universities. Responsible for funding research in the areas of Wireless Transceiver IC Design, RF, and mixed-signal and baseband system architecture.

1985-87: Member of Research Staff, Boeing Co., Bellevue, Wa, Flight Systems Research and Technology Center, summer. Design Engineer, Hardware and CAD tool development for system control.

AWARDS

- IEEE Fellow 2004-Present
- IEEE Fellows CAS Committee Chair, 2009-2012
- Global Standards Award, For contributions in the International Telecommunication Unit (ITU) for Asymmetric Digital Subscriber Line (ADSL) G.Lite Standards. Motorola Inc., 1999.
- 10X Cycle Reduction Award, for development of new IC design process from DSP algorithm to IC layout, Motorola Inc., 1995.
- IEEE Darlington best paper Award, IEEE Circuits and Systems Society Best Paper Award, 1995. For "Characterization and Comparison of CMOS FSCL Circuits with Conventional CMOS for mixed-signal ICs," Published at: *IEEE Trans. on Circuits and Systems II, Sept. 93*.

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- Carter Best Teaching Award, College of Engineering Best Teacher Award, Oregon State University, 1992. For “*outstanding and inspirational teaching in the College of Engineering*”. Award is selected by the confidential vote of all of the undergraduate students in the College of Engineering among over 125 professors in the College.
- Industrial University Fellowship (IUF) Award, *National Science Foundation*, 1993.
- Research Initiation Award, *National Science Foundation*, 1990-93.
- Outstanding Graduate Student Scholarship, *Azur-Data Inc.* WSU, 1984

RESEARCH PROJECTS

Partial list of Research Awards (1987-Present):

- **2021-2026 – U.S. Agency for International Development (USAID)**
 - COE – Center of Excellence for Energy, PI and Director, \$22.5M.
- **2020-2022 - The National Science Foundation (NSF)**
 - SII Planning: Center for Next Generation Wireless Spectrum Sharing, PI, \$300K.
- **2002-2020 – The National Science Foundation (NSF) - Connection One**
 - Industry/University Cooperative Research Center (IUCRC), NSF contribution \$1.5M.
 - Annual Industry Contribution: Total over \$5M.
- **2015-2016 – The National Science Foundation (NSF)**
 - Integration of Smart Utility Grids with Dynamic Optical Communication Networks for Intelligent Distribution of Power Workload and Data in Disaster, \$200K
- **2015-2020 – U.S. Agency for International Development (USAID)**
 - PCASE – Center for Energy systems, PI and Director, \$18M.
- **2014-2015 NSF – Connection One**
 - Various projects funded by the Connection one center
- **2013-2014 NASA**
 - Arizona Space Grant Consortium, NASA: Goddard Space Flight Center, RADHARD electronics, \$200K
- **2012-2015 – Solar Energy, Private Donor**
 - Solar Energy Development on international projects, \$2M
- **2011-2014 – Semi-Conductor Research Corporation**
 - Self-Characterization for Calibration and Process Feedback of MEMS Devices, , \$300K
- **2011-2013 - The National Science Foundation (NSF)**
 - Microwave & RF Bio-Sensors for Vital Signs Monitoring Device Design, \$250K
- **2010-2011 – The National Science Foundation**
 - Adaptive Compensation of Analog circuits imperfections using DSP methods, \$150K,

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- **2010-2011 – The National Science Foundation**
 - Autonomous Self-Healing Sensor Network Radio and Mixed-Signal Readout System Design
National Science Foundation (NSF), \$300K
- **2010-2020 – The National Science Foundation (NSF)**
 - QESST NSF ERC Center on Solar Energy, Co-PI, Testbed Director
- **2010-2015 - The National Science Foundation (NSF)**
 - Research Experience for Undergraduate Students, total \$400K
- **2008-2013 - The Science Foundation of Arizona (SFAZ)**
 - PEPER- Photovoltaic Environmental Performance and Reliability for the Arizona-Wide Electric Grid, \$1.2M.
- **2008-2009 - The National Science Foundation (NSF)**
 - Micropower MICS Band RF Transceiver Design (C1/TI Enhancement Project), \$200K
- **2007-2011 – The National Science Foundation (NSF)**
 - Micro-Power Multi-Phase on-chip MEMS Hearing Aid, 2007-2011, \$500K.
- **2007-2009 - The National Science Foundation (NSF)**
 - High Efficiency Power Delivery and Front-End Module Design for Implantable Bio-Sensors
\$480K
- **2005-2009 - The National Science Foundation (NSF)**
 - Cognitive MIMO Communications for Dynamic-Spectrum Wireless Networks \$150K
- **2005-2009 - The National Science Foundation (NSF)**
 - Autonomous Self-Healing Sensor Network Radio, , \$250K
- **2005-2008 BAE Systems**
 - Integrated on-chip Time Measurement Circuits LiDAR; \$650K
- **2005-2008 - Freescale Semiconductor**
 - PWM, Battery & Power management, \$150K
- **2005-2006 - DOD: Defense Advanced Research Projects Agency (DARPA)**
 - Radhard by Design - MRC/DARPA, Total funding \$1.5M
- **2005-2010 - State of Arizona**
 - WINTECH- Wireless Integrated Nano Technology Center Support, 450K annually, total \$2.5M
- **2004-2005 – NASA**
 - Integration of Ultra-Low power RF CMOS, \$127K
- **2004-2008 – Deference Advance Research Project Agency (DARPA)**
 - Implanted Neural-Enabled Prostheses bio-sensor with Sensorimotor Integration, \$500K
- **2004-2008 – Deference Advance Research Project Agency (DARPA)**
 - Nano-Mechanical RF Band pass resonator for 2GHZ RF Applications, with JPL, \$2.2 M,

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- **2003-2005 - DOD-ARMY-ARL: Army Research Office (ARO)**
 - Implanted Neuro-sensor, \$175K
- **2002-2005 - Intel Corporation**
 - Design of Multi-Standard RF Front-End Circuits for Cellular and WiFi, \$300K
- **2002 – SRC**
 - LOW POWER ULTRA - WIDE BAND GEOLACTION SYSTEMS, \$65K.
- **2001-2003 - SRC (Semi-conductors research Corp)**
 - Ultra-Wideband Transceivers for cellular and WiFi 802.11, \$225K
- **1987-1993 - The National Science Foundation**
 - Center for the Design of Analog/Digital IC's (CDADIC) 1987-1995, At Oregon State, \$1.5M
- **1992-1994 – Motorola LMPS**
 - Low Power IF processing for Direct Digital Transceivers, \$100K,
- **1993 - Hewlett-Packard**
 - Hewlett-Packard Faculty Chair position in Mixed-Signal IC, HP, \$500K
- **1992-1993 - The National Science Foundation**
 - National Science Foundation, Motorola Inc. Faculty Industry Fellowship, \$250K,
- **1992-1993 - The National Science Foundation**
 - National Science Foundation, Research Initiation Award (RIA) (same as current CAREER Award), Synthesis and Automatic Derivation of Multi-Rate VLSI Arrays for DSP Algorithms, \$320K.
- **1988-1992 – Center for the Design of Analog/Digital IC's (CDADIC)**
 - CDADIC, various projects on Low-Noise Source Coupled Logic (SCL), Mixed-Mode IC's, CDADIC \$350K.
- **1988- Tektronix Inc.**
 - Decimation Filters for A/D Noise Enhancements, Tektronix, Inc., \$100K,
- **1987-1993 – DARPA, MOSIS, Tektronix, IT, Motorola**
 - Various grants for IC Fabrication (DARPA/MOSIS, VLSI)
 - Testing equipment (Tek, HP)
 - DSP system development (TI, Motorola)

PROFESSIONAL RECOGNITION

- IEEE Fellow, 2004-Present
- IEEE Fellow Committee Chair, CAS, 2008-2010
- IEEE Fellow Committee member, 2007-2010.
- IEEE Senior Member, 1993-Present, IEEE Member 1987-1992.

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- IEEE Faculty Advisor, Oregon State University, 1987-1990

IEEE Editorials

- IEEE Microwave Magazine, Editor,
- IEEE System Journal, Associate Editor, 2010-2011.
- IEEE Transactions on VLSI, Associate Editor, Jan 2001-2008.
- IEEE Communication Magazine, Editor, Feature Issues on “Circuits for Wireless and Wireline Communications,” April 1999.
- IEEE Transactions on Microwave Theory and Techniques , editor, Special Issue on: "Radio Frequency IC Design," Dec. 1998.
- IEEE Transactions on Circuits and Systems-II, editor, Special Issue on: “Low-Power Wireless Communication Systems,” June 1997.
- Associate Editor, IEEE Transactions on Circuits and Systems-II, 1993-1996.
- *Editor and Reviewer for many IEEE journals and conferences*
- *Founding member of IEEE RF Integrated Circuits Symposium*
- *Associate Editor, IEEE Communications, Tutorial & Surveys Magazine, 2006-2009.*

Conference Organizations

- RFIC Executive Committee members, 2000-2017
- RFIC Steering Committee Member, RFIC symposium, 1996-2017.
- RFIC Founding member, 1995-96.
- Technical Program Chair, IEEE International Sym. on Circuits and Systems, Phoenix, AZ, 2002.
- ISSCC Admin Council, Conferences Committee 2000-2005.
- General Chair, Radio Frequency IC (RFIC) Symposium, Seattle, WA, 2002.
- Technical Program Chair, RFIC Symposium, Phoenix, AZ, 2001.
- Finance Chair, RFIC symposium, Boston, MA, 2000.
- Publicity Chair, RFIC symposium, Los Angeles, CA, 1999.
- Transactions Chair, RFIC symposium, Baltimore, MD, 1998.
- General Chair, Int. Sym. on Low-Power Electronics and Design (ISLPED), Monterey, CA, 97.
- Executive Committee Member, Int. Symp. On Low-Power Electronics and Design, 96-2000.
- Technical Program Committee Member of the following conferences:
 - International Conference on Circuits and Systems: 1996, 2000, 2001, 2004-2008
 - RFIC Symposium, 1996-2018
 - Application Specific Array Processing (ASAP): 2000-2002
 - Technical Program Chair, Int. Sym. on Low-Power Electronics and Design, Monterey, CA, 96.

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- Arizona Telecom Comm (ATIC)
- GLS VLSI 1998, Lafayette, Louisiana, 1998
- VLSI Design 98, Chennai, India, Jan. 1998.
- ICECS, Lisbon, Portugal, 98.
- Application Specific Array Processing, 1995-97, 2000
- Vehicular Technology Conference, 1995-97.
- Inter. Conf. on Intelligent Information Systems, D.C., 1994-95.
- IEEE Pacific Rim Conference on Communications & Computers, Victoria, BC, Canada, 1991.

Invited talks, Panelist, Session Chairs, Workshop Speaker

- Conference chair, Technical Program committee chair and TPC member, tutorials, workshops, session chair, etc. in RFIC, ISSCC, ISCAS, VLSI, ICASSP, Low-Power Symposium, ICC, Application Specific IC's, IMS, MTT, etc.

CONSULTANT

- Intel Inc. Chandler, AZ, 2002-2006: Development of 3G-4G Wireless transceiver.
- Sony Inc., San Diego, CA and Tokyo, Japan, 2002-2004: Review and development of various telecom cellular system architecture including 3G system architecture, and GPS system.
- Motorola Inc. 2002-2005: Supporting development of BT, WiFi, E911, GPS integrated circuits and systems for the cellular and mobile handsets.
- Hewlett Packard, Corvallis, OR – 1990-1993: Various project on development of custom analog and digital IC's for printer and inkjet system. Some of this work was under consultation, and some under various research grants with Oregon State University.
- Tektronix Inc, Beaverton, OR - 1988-1990: Design and Implementation of Data acquisition system for Spectrum analyzer, development of custom DSP algorithm for the Tektronix spectrum analyzer including system architecture, simulation, analysis, and design of oversampled data acquisition system.
- Boeing Commercial Aircraft, BCAC, Renton, WA - 1985-1987: Development of Airplane Controller Model, Simulation and Implementation of Flight control, Model reduction, and system control.

EXPERT WITNESS (Patent, IP)

Patent litigation, patent validity, IPR, expert reports, deposition, testimony, and trade secrets in the following areas (Complete list of cases available):

- Analog and Digital IC
- Radio Frequency Integrated Circuits
- Power Management, Battery Management, PMIC
- Wireless communication, 3G, 4G, OFDM, WiFi, 802.11, Bluetooth, and related areas
- Audio and acoustic signal processing, Audio Array processing
- Communication networks, Communication system

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- Signal Processing, adaptive signal processing
- DSL, xDSL, VDSL, OFDM, Multi-Tone, and related areas
- Cable MODEM DOCIS MODEM, and related areas.
- Hearing AID
- Bio-Electronics, Heart monitoring system, Bi-sensors
- Satellite communications, Satellite Transceiver, ECHO and Multi-path cancelation circuits
- Wireline Communications, MODEM, Digital Subscriber Line, ADSL, VDSL, MODEM
- Wireless LAN, Wi-Fi, 802.11
- Bluetooth
- ZIGBEE
- GPS system, GPS receiver
- MEMS, Bulk Acoustic Wave Filters, SAW, MEMS resonators, MEMS accelerometer
- Wireless Standards (ITU, ETSI, 3GPP, LTE) including AMPS, GSM, CDMA, WCDMA, LTE, 1G, 2G, 3G, 4G, BT, WiFi (802.11)
- Wireline standards including DSL, MODEM and DOCIS, and related standards ITU/ETSI

PATENTS, PUBLICATIONS

Patents and Patent Applications

ID	title	assignee	inventor/author
AU-2003222007-A8	Oscillator frequency correction in gps signal acquisition	Motorola Inc	Sayfe Kiaei, Thomas M King, George J Geier
WO-03093858-A3	Oscillator frequency correction in gps signal acquisition	Motorola Inc	Thomas M King, George J Geier, Sayfe Kiaei
WO-2004048909-A3	Compressed vector-based spectral analysis method and system for nonlinear rf blocks	Univ Arizona, Shahin Farahani, Sayfe Kiaei, Nazanin Darbianian	Shahin Farahani, Sayfe Kiaei, Nazanin Darbianian
US-2006226909-A1	Monolithic supply-modulated rf power amplifier and dc-dc power converter ic	Siamak Abedinpour, Sayfe Kiaei	Siamak Abedinpour, Sayfe Kiaei
US-7218085-B2	Integrated ZVS synchronous buck DC-DC converter with adaptive control	Arizona Board Of Regents	Siamak Abedinpour, Sayfe Kiaei
US-7372333-B2	Monolithic supply-modulated RF power amplifier and DC-DC power converter IC	Arizona Board Of Regents, Acting For And On Behalf Of Arizona State University	Siamak Abedinpour, Sayfe Kiaei
US-7528754-B1	Finite impulse response digital to analog converter	Arizona Board Of Regents	Bertan Bakkaloglu, Sayfe Kiaei, Shahin Taleie
US-2018049703-A1	Wireless in-shoe physical activity monitoring	Timothy W. Markison, Sayfe Kiaei, Gary McCoy	Timothy W. Markison, Sayfe Kiaei, Gary McCoy
US-10264996-B2	Method and apparatus for wirelessly monitoring repetitive bodily movements	Sayfe Kiaei	Sayfe Kiaei
US-2019231226-A1	Method and apparatus for wirelessly monitoring repetitive bodily movements	Sayfe Kiaei	Sayfe Kiaei
US-10653337-B2	Local object detection system	Timothy W. Markison, Sayfe Kiaei, Gary McCoy	Timothy W. Markison, Sayfe Kiaei, Gary McCoy
US-2020266708-A1	Electronic circuit and method of controlling three-level switching converters	Arizona Board Of Regents On Behalf Of Arizona State University	Parisa Mahmoudidaryan, Sayfe Kiaei, Bertan Bakkaloglu
US-11108325-B2	Electronic circuit and method of controlling three-level switching converters	Arizona Board Of Regents On Behalf Of Arizona State University	Parisa Mahmoudidaryan, Sayfe Kiaei, Bertan Bakkaloglu
US11129547B2	Wireless in-shoe physical activity monitoring	SigmaSense LLC	Timothy W. Markison, Sayfe Kiaei, Gary McCoy

Standards Contributions

1. "Spectral Compatibility of ADSL: Frequency Overlap vs. FDM," T1E1, Dec. 97.
2. "Echo Cancellation for G.Lite Universal ADSL," OFDM, Universal ADSL Working Group, Atlanta, GA, Jan 98.
3. "8-bit QAM Constellation effects on reach for universal ADSL," OFDM, Universal ADAL Working Group, Atlanta, GA, Jan 98.
4. "Trellis Code Modulation coding gain for OFDM," Universal ADSL Working Group, Atlanta, GA, Jan 98.
5. "Monte Carlo Modeling and simulation of twisted pair wiring for OFDM," Universal ADAL Working Group, Atlanta, GA, Jan 98.
6. "Overlap Upstream/Downstream spectral allocation for OFDM ADSL," International

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Telecommunication Unit, Chicago, March 98.

7. "Echo Cancellation for ADSL OFDM," International Telecommunication Unit, Antwerp, Belgium, 98.
8. "Performance of Echo Cancellation ADSL in OFDM system in the presence of Near End Cross Talk (NEXT)," International Telecommunication Unit, Honolulu, Hawaii, June 98.
9. Presentations and editorials at various XDSL and OFDM standards: ITU, ETSI, UAWG, and T1E1, 97-99.
10. Presentations and editorials at various 3G and 4G and wireless standards including ITU, 3GPP, 802.11, BT,

Books

"Design, Modeling and Testing of Data Converters, P Carbone, S Kiaei," F Xu - 2014 – Springer, © Springer-Verlag Berlin Heidelberg 2014

Refereed Journal Papers

1. CMOS Full-Duplex Mixer-First Receiver With Adaptive Self-Interference Cancellation S. -A. Ayati; A. Alizadeh; S. Kiaei, IEEE Transactions on Circuits and Systems I, Jan 2021.
2. A 10-W X-Band Class-F High-Power Amplifier in a 0.25μm GaAs pHEMT Technology, A. Alizadeh; M. Yaghoobi; M. Meghdadi; A. Medi; S. Kiaei, IEEE Transactions on Microwave Theory and Techniques, Jan 2021.
3. An X-Band Class-J Power Amplifier With Active Load Modulation to Boost Drain Efficiency A. Alizadeh; S. Hassanzadehyamchi; A. Medi; S. Kiaei, IEEE Transactions on Circuits and Systems I: Sep 2020
4. In-Field Recovery of RF Circuits from Wearout Based Performance Degradation D. Chang; J. N. Kitchen; S. Kiaei; S. Ozev, IEEE Transactions on Emerging Topics in Computing, Jun 2020
5. A 50-V Isolation, 100-MHz, 50-mW Single-Chip Junction Isolated DC-DC Converter With Self-Tuned Maximum Power Transfer Frequency, C. Liu; D. Mandal; Z. Yao; M. Sun; J. Todsén; B. Johnson; S. Kiaei; B. Bakkaloglu, IEEE Transactions on Circuits and Systems II: Express Briefs, May 2019
6. Wideband Hybrid Envelope Tracking Modulator With Hysteretic-Controlled Three-Level Switching Converter and Slew-Rate Enhanced Linear Amplifier, P. Mahmoudidaryan; D. Mandal; B. Bakkaloglu; S. Kiaei, IEEE Journal of Solid-State Circuits, 2019.
7. Low-Power/Low-Voltage Integrated CMOS Sense Resistor-Free Analog Power/Current Sensor Compatible With High-Voltage Switching DC-DC Converter, S. Singh; D. Mandal; B. Bakkaloglu; S. Kiaei IEEE Transactions on Circuits and Systems I, 2019
8. Adaptively Biased Output Cap-Less NMOS LDO With 19 ns Settling Time, D. Mandal; C. Desai; B. Bakkaloglu; S. Kiaei, IEEE Transactions on Circuits and Systems II: Express Briefs, 2019
9. Chirag Desai; Debashis Mandal; Bertan Bakkaloglu; Sayfe Kiaei, "A 1.66 mV FOM Output Cap-Less LDO With Current-Reused Dynamic Biasing and 20 ns Settling Time," IEEE Solid-State Circuits Letters Year: 2018, Volume: 1, Issue: 2, Pages: 50-53
10. Debashis Mandal ; Chirag Desai ; Bertan Bakkaloglu ; Sayfe Kiaei, Adaptively Biased Output Cap-Less NMOS LDO with 19 ns Settling-Time;; IEEE Transactions on Circuits and Systems II: Feb 2019
11. Ayati, Mandal, Bakkaloglu, Kiaei, "Integrated Quasi-Circulator With RF Leakage Cancellation for Full-Duplex Wireless Transceivers," IEEE Trans of Microwave theory and techniques, Dec 2017.
12. "A 50-mA 99.2% Peak Current Efficiency, 250-ns Settling Time Digital Low-Dropout Regulator With Transient Enhanced PI Controller", ChaiYong Lim ; Debashis Mandal ; Bertan Bakkaloglu ; Sayfe Kiaei; IEEE Transactions on Very Large Scale Integration (VLSI) Systems; Year: 2017, Volume: 25, Issue: 8; Pages: 2360 - 2370

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13. Doohwang Chang; Jennifer N. Kitchen; Sayfe Kiaei; "Sule Ozev, In-field Recovery of RF Circuits from Wearout Based Performance Degradation", IEEE Transactions on Emerging Topics in Computing, 2017.
14. Edgar Martí-Arbona; Debashis Mandal; Bertan Bakkaloglu; Sayfe Kiaei, A High-Voltage-Compliant Current-to-Digital Sensor for DC–DC Converters in Standard CMOS Technology, IEEE Transactions on Power Electronics, 2017, Volume: 32, Issue: 3. Pp. 2180 - 2188
15. Michael Cheah ; Debashis Mandal ; Bertan Bakkaloglu ; Sayfe Kiaei, "A 100-mA, 99.11% Current Efficiency, 2-mVpp Ripple Digitally Controlled LDO With Active Ripple Suppression", Aug 2016.
16. Marti-Arbona, E.; Mandal, D.; Bakkaloglu, B.; Kiaei, S., "A High-Voltage Compliant Current-to-Digital Sensor for DC-DC Converters in Standard CMOS Technology," *IEEE Transactions on Power Electronics*, no. 99, 2016.
17. Chang, D.; Kitchen, J.N.; Bakkaloglu, B.; Kiaei, S.; Ozev, S., "Monitor-Based In-Field Wearout Mitigation for CMOS LC Oscillators," in *IEEE Transactions on Device and Materials Reliability*, vol. 16, no. 2, pp. 183-193, 2016.
18. Chang, D.; Kitchen, J.N.; Bakkaloglu, B.; Kiaei, S.; Ozev, S., "Design-Time Reliability Enhancement Using Hotspot Identification for RF Circuits," in *IEEE transactions on Very Large Scale Integration (VLSI) Systems*, -vol. 24, no. 3, pp. 1179-1183, 2016
19. Seungkee Min; Copani, T.; Kiaei, S.; Bakkaloglu, B., "A 90-nm CMOS 5-GHz Ring-Oscillator PLL With Delay-Discriminator-Based Active Phase-Noise Cancellation," *Solid-State Circuits, IEEE Journal of*, vol.48, no.5, pp.1151,1160, May 2013
20. Junghan Lee; Tino Copani; Terry Mayhugh Jr.; Bhaskar Aravind; Sayfe Kiaei; Bertan Bakkaloglu., "A 280 mW, 0.07% THD+N class-D audio amplifier using a frequency-domain quantizer," *Analog Integrated Circuits and Signal Processing*, 173-186, 2012.
21. Seungkee Min; Copali, T.; Kiaei, S.; Bakkaloglu, B., "A 90nm CMOS 5GHz ring oscillator PLL with delay-discriminator based active phase noise cancellation," *Radio Frequency Integrated Circuits Symposium (RFIC), 2012 IEEE*, pp. 173-176, 2012
22. Deligoz, I.; Naqvi, S.R.; Copani, T.; Kiaei, S.; Bakkaloglu, B.; Sang-Soo Je; Junseok Chae; , "A MEMS-Based Power-Scalable Hearing Aid Analog Front End," *Biomedical Circuits and Systems, IEEE Transactions on* , vol.5, no.3, pp.201-213, June 2011
23. Copani, T.; Seungkee Min; Shashidharan, S.; Chakraborty, S.; Stevens, M.; Kiaei, S.; Bakkaloglu, B., , "A CMOS Low-Power Transceiver With Reconfigurable Antenna Interface for Medical Implant Applications," *Microwave Theory and Techniques, IEEE Transactions on* , vol.59, no.5, pp.1369-1378, May 2011
24. Khalil, W.; Shashidharan, S.; Copani, T.; Chakraborty, S.; Kiaei, S.; Bakkaloglu, B., , "A $700\text{-}\mu\text{A}$ 405-MHz All-Digital Fractional- N Frequency-Locked Loop for ISM Band Applications," *Microwave Theory and Techniques, IEEE Transactions on* , vol.59, no.5, pp.1319-1326, May 2011
25. Lashkarian, N.; Nassiri-Toussi, K.; Jula, P.; Kiaei, S., , "Performance Bound on Ergodic Capacity of MIMO Beam-Forming in Indoor Multi-Path Channels," *Communications, IEEE Transactions on* , vol.58, no.11, pp.3254-3264, November 2010
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96. "DC offset correction for direct conversion transceivers," Great Lake VLSI Symposium, Lafayette, Louisiana, 1998. [C. Sandalci, S. Kiaei]*
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98. "Low-Power RF Design," Design Automation Conference (DAC), Anaheim, CA, June 1997. [S. Kiaei]
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122. "Systematic Derivation of Multi-Rate VLSI Arrays for the Solution of Toeplitz Matrices," IEEE Great Lakes Symposium on VLSI, March 1991. Proc. of IEEE Pacific Rim Conference on Communications, Computers, and Signal Processing, Victoria, BC, Canada, pp. 623-626, May 1991. [S. Kiaei]
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126. "VLSI Design of Dynamically Reconfigurable Array Processors-DRAP," Proc. of International Conference on Acoustics, Speech, and Signal Processing, Glasgow, Scotland, 1989. [S. Kiaei, J. Durgham]
127. "VLSI Design of Bit/Serial Adaptive IIR Filters," Proc. of IEEE Pacific Conference on Communications, Computers, and Signal Processing, Victoria, Canada, pp. 650-652, June 1989. [R. Badyal, S. Kiaei]
128. "CCA Approach for ARMA Spectral Analysis," Proc. of IEEE International Symposium on Circuits and Systems, Portland, OR, pp. 1319-1322, May 1989. [S. Kiaei, L. Luo]
129. "Canonical Correlation Analysis (CCA) for ARMA Spectral Estimation," IEEE International Symposium on Circuits and Systems, May, 1989. [Kiaei, S.; Luo, L.]

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130. "VLSI Implementation of Adaptive Bit/Serial IIR Filters," IEEE Pacific Rim Conference on Communications, Computers and Signal Processing, June 1989. [Badyal, R.; Kiaei, S.]
131. "VLSI design of WAP for Recursive Equations," VLSI Signal Processing, 1988. [S. Kiaei, U. Desai]
132. "Independent Data Flow Wavefront Array Processors for Recursive Equations," Proc. of 20th Annual Conference on Information Sciences and Systems, Princeton University, NJ, 1986. [S. Kiaei, U. Desai]
133. "A Stochastic Realization Approach to Reduced-Order Hierarchical Estimation," Proc. of 24th IEEE Conference on Dec., Ft. Lauderdale, FL, pp. 416-421, December 1985. [U. Desai, S. Kiaei]
134. "Hierarchical Estimation Algorithms," Proc. of IEEE Conference on Man, Cybernetics, and Systems, Tucson, AZ, October 1985. [U. Desai S. Kiaei]
135. "Approximation of Markovian Models with Non-Constant Parameters," Proc. of 23rd IEEE Conference on Dec., Las Vegas, NV, pp. 1642-1644, December 1984. [U. Desai, S. Banerjee, S. Kiaei]
136. "A Canonical Correlation Approach to Reduced-Order LQR Design," Proc. of 23rd IEEE Conference on Dec., Las Vegas, NV, pp. 1523-1528, December 1984. [U. Desai, S. Banerjee, S. Kiaei]

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GRADUATE STUDENT ADVISEES & RESEARCH PROJECT

(Partial list of Students graduated, current employment to the best of my knowledge)

1. J. Durgam, VLSI Design of Dynamically Reconfigurable Array Processors, MSEE, 1988. Intel.
2. J. Gilbert, Minimization Techniques for PLAs, MSEE, 1988, Tektronix Inc.
3. L. Luo, CCA Methods for ARMA Spectral Estimation, MSEE, 1989. Berkeley Research Center
4. E. Zahl, Enhancement Methods for A/D Noise Reduction, MSEE, 1989. AT&T
5. L. Aihua, Synthesis of MRAs, MSEE, 1990. Intel.
6. F. Aslam, Image Restoration Methods, MSEE, 1990.
7. S.H. Chee, FSCL Circuits for Mixed-Mode IC's, MSEE, 1990. Linear Tech.
8. C. Dawson, MSEE, 1990. Boeing
9. A. Chow, Source-Coupled Logic ALU, MSEE, 1990. Intel
10. S. Maskai, Decimation Filters Using FSCL Circuits, MSEE, 1991. Intel
11. L. Louis, VLSI Implementation of Toeplitz Matrices, MSEE, 1991.
12. R. Badyal, Bit/Serial VLSI Design of IIR Filters, MSEE, 1992, HP
13. Lap Mui, Piece-Wise Linear Schedule for VLSI Arrays, MSEE, 1992. HP
14. S. Abdennadher, Adaptive Sigma-Delta Modulators, MSEE, 1992. Level One / Intel.
15. H. Bribech, Second Order Adaptive A/D Schemes, MSEE, 1992.
16. B. Hickman, MSEE, 92. Tektronix
17. M. Maleki, Current-Mode Flash A/D, MSEE, 1992. University of Oregon
18. Man Wong, Low-Noise Decimation Filter for Mixed-Mode ICs, MSEE, 1993, Motorola.
19. Anu Krishna Swamy, Low Noise IC Blocks for Mixed-mode IC's, MSEE, 1993, Ph.D., 1997.
20. Manu Srivastava, Comparison of Differential Logic (FSCL, CVSL, DSLL), MSEE, 1994, Intel.
21. Joel Oren, VLSI Design of Asynchronous FIR Filters, MSEE thesis, Feb. 1994. E-Systems.
22. Y. Zheng, VLSI Design and Synthesis of Multi-Rate Arrays, Ph.D. March 94, Hughes Research.
23. Satish Kulkarni, Low-Sensitivity Filters, MSEE, 1995, Motorola.
24. Amit Dutta, Multi-user Interference Cancellation, Ph.D, Dec. 97, Faculty, India.
25. Dwight Poplin, Multiplierless MPEG Decoder, MSEE, 1996. HP.
26. Maxim Scarpa, Adaptive I/Q Miss-match Correction for Direct Conversion Receivers, MSEE 1998.
27. Jeff McNeal, Sigma-Delta Frequency-to-Time Conversion, MSEE, 1998. Level One Comm.
28. Julia Vogel, Adaptive DC offset Cancellation, MSEE, 1998. Faculty in Germany.
29. Takao Inoue, MS, Echo Cancellation for ADSL, 1998. MSEE, The U of Texas at Austin.
30. Navid Lashkarian, Frequency off-set estimation and Synchronization of OFDM systems, Ph.D., June 1999. Broadcom Inc. & Faculty at UC San Jose.

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31. Guner Arslan, (co-advisor with B. Evans), "Fast Equalization for DMT systems, with applications to ADSL," Ph.D. The University of Texas at Austin, 2000
32. Salem Abdennadher, I/Q Mismatch Correction for RF Wireless transceivers, Ph.D., Level One Comm/Intel.
33. Can Sandalci, DSL Line Driver, Ph.D., 2001, Intel.
34. Dean Badillo, Low-Cost VCO Ring Oscillators, PhD, 2004, Intel, Chandler,
35. Siamak Abedinpour, PhD, 2005 Freescale, Tempe, Arizona
36. Hemanth Shivalingaiah, Multi-Band Low Noise Amplifiers, Ph.D., 2006, Intel,
37. Shahin Farahani, PhD, 2006, Qualcomm Inc,
38. Nazanin Darbanian, M.S. Freescale, Tempe, Arizona
39. *Joe Rutkowski, Joseph, MS, 2004, Phillips.*
40. *Chaudhuri, Bikram, Synthesizer, MS/PhD, MS 2004.*
41. *Zhang, Jiandong, MEMs, MEMS, December-04*
42. *Afsahi, Ali, MS/PHD, UC San Diego, QUALCOMM, Connection One*
43. *Chen, Xiaomin, UWB, PHD, 2007, SRC/Motorola*
44. *Jali, Hilda, Power Management, MS, June-05,*
45. *Xuejin Wang, RF Optimization, 2006 CAD tools, PhD, Neo-Linear*
46. *Umar Lyles, Power Amplifier, MS, 2006. Texas Instruments*
47. MS, Erika Munoz, RADHARD, 2007, Intel
48. Waleed Khali, (Co-Advisor), Professor at Ohio State
49. Jennifer Kitchen, PhD, 2009, Professor at ASU
50. Shahin Mehdizad Taleie, RFDAC, PhD, 2009, Qualcomm
51. Ilker Deligoz, PHD, 2009, Qualcomm
52. Hyung Kim, PhD, Jan 2010, Intel
53. Jung Le, PhD 2010, Intel, TI
54. Syed Naqvi, PhD, 2012, Intel.
55. Todd Martin, MS, 2011, TI
56. Seungkee Min, PhD, 2011, Intel
57. Ali Meamar, Post Doc, RFIC 2013
58. Hitesh Khunti, MS 2013, Qualcom
59. Debashis Mandal, Post Doc, Research faculty 2015-2018
60. Edgar Martinez, PhD, 2015, Qualcomm
61. Chirag Desai, MS, 2016, Qualcom
62. Sanjay Avasarala, MS, 2016

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- 63. Li Ming, MS, 2017
- 64. Qirong Peng, MS, 2017,
- 65. Yu Geng, PhD, 2018
- 66. Amir Ayati, PhD Aug 2018; Qualcomm
- 67. Pasisa Mahmoudi, PhD, May 2019, Qualcomm
- 68. Chai Yong, MS: 2015, PHD: 2019, Qualcomm
- 69. Shrikant Singh, MS: 2016, PhD, 2019, Movandi
- 70. Amir Alizadeh, Research Faculty 2019-Present
- 71. Ata S. PhD, 2021, Ata Sarrafinejad, PhD, 2021

UNIVERSITY COMMITTEES

Various Committees at ASU, Oregon State University, etc.

INDUSTRY COMMITTEES

- Arizona Telecommunications and Information Council (ATIC), Board Member
- CAS Fellows Committee (ends December 31, 2006)
- *IEEE CAS Phoenix Chapter Organizers (the committee is in the process of determining new chair – current chair not active)*
- *Executive Committee, RFIC 2006.*
- *Technical Program Comm, IEEE RFIC 2006.*
- *Executive Committee, Conferences, International Solid State System's Conference.*
- *IEEE CAS Society, VLSI Technical Comm. Member*
- *Editorial Board, IEEE Communications Surveys & Tutorials*
- *Radio Frequency Integrated Circuits- RFIC 2006*
- *IEEE RF Integrated Circuits Conference, Committee Chair for two workshops*
- *International Microwave Symposium, IMS-MTT 2006*
- *Int. Symposium on Circuits and Systems - ISCAS 2006*
- *Wireless Networks & Emerging Technologies, WNET06*
- *Midwest Symposium on Circuits and System*
- *Arizona Governor IT Advisory Committee – GITA*
- *Arizona Telecom – ATIC*

INSTRUCTIONAL SUMMARY

- Digital IC Design, Analog IC Design, Advance CMOS Analog IC, VLSI, RFIC Design
- Wireless Transceiver Design, Wireless Communications, GPS, Telecomm Systems, Digital Communication

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- Signal Processing, Advance digital signal processing, Communication, Digital Communication, Digital Audio Processing, Adaptive array processing
- Computer Architecture, Microprocessor System Architecture, Pipeline Array Processing