

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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VOLEX PLC,

Petitioner,

v.

CREDO TECHNOLOGY GROUP LTD.,

Patent Owner.

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Case No. IPR2025-01386

U.S. Patent No. 11,012,252

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**PETITION FOR *INTER PARTES* REVIEW**

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## **LIST OF EXHIBITS**

| <b>Exhibit</b> | <b>Description</b>                                                                                                                |
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| 1001           | U.S. Patent No. 11,012,252                                                                                                        |
| 1002           | Prosecution History of U.S. Patent No. 11,012,252                                                                                 |
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| 1006           | U.S. Patent No. 7,762,727 (“Aronson”)                                                                                             |
| 1007           | U.S. Patent Application Publication No. 2013/0115803 (“Tang”)                                                                     |
| 1008           | DS125DF1610 9.8 to 12.5 Gbps 16-Channel Retimer Datasheet, SNLS482B, Texas Instruments Incorporated (January 2017) (“TI-Retimer”) |
| 1009           | Affidavit of Tanya Zeif                                                                                                           |
| 1010           | U.S. Patent Application Publication No. 2020/0194911 (“Ayzenberg”)                                                                |
| 1011           | U.S. Patent Application Publication No. 2011/0228821 (“van der Horst”)                                                            |
| 1012           | U.S. Patent Application Publication No. 2010/0210142 (“McGrath”)                                                                  |
| 1013           | U.S. Patent Application Publication No. 2013/0280955 (“Alden”)                                                                    |
| 1014           | U.S. Patent Application Publication No. 2006/0045176 (“Moughabghab”)                                                              |
| 1015           | U.S. Patent Application Publication No. 2010/0232492 (“Mezer-492”)                                                                |
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| 1017           | U.S. Patent No. 6,621,862 (“Dabell”)                                                                                              |
| 1018           | U.S. Patent No. 6,055,269 (“Drost”)                                                                                               |
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| 1026           | SFF-8642 Specification for MINI MULTILANE SERIES: SHIELDED INTEGRATED CONNECTOR, Rev 2.7, SFF Committee, February 26, 2010        |
| 1027           | SFF-8432 Specification for SFP+ Module and Cage, Rev 5.2a, SFF Committee, November 30, 2018                                       |
| 1028           | IEEE Standard for Ethernet, IEEE 802.3 (2015) Section One                                                                         |

| Exhibit | Description                                                                                                                                                                                                                                                                                                                                                    |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1029    | IEEE Standard for Ethernet, IEEE 802.3 (2015) Section Six                                                                                                                                                                                                                                                                                                      |
| 1030    | Texas Instruments Application Report SNLA225, “Selecting TI SigCon Devices for SFF-8431 SFP+ Applications.” Texas Instruments Inc. (June 2014) (available at <a href="https://web.archive.org/web/20151031185909/https://www.ti.com/lit/an/snla225/snla225.pdf">https://web.archive.org/web/20151031185909/https://www.ti.com/lit/an/snla225/snla225.pdf</a> ) |
| 1031    | Proakis, John G., <i>Digital Communication</i> , McGraw-Hill, 4th Edition, 2000, pp. 583-635 (“Proakis”)                                                                                                                                                                                                                                                       |
| 1032    | Hanumolu, P. K. et al., “Equalizers for High-Speed Serial Links.” <i>International Journal of High Speed Electronics and Systems</i> , vol. 15, no. 2, 2005, pp. 429-458 (“Hanumolu”)                                                                                                                                                                          |
| 1033    | Declaration of Paul S. Min, Ph.D., together with Dr. Min’s c.v., which are Exhibits 1003 and 1004 in Case No. IPR2025-00834                                                                                                                                                                                                                                    |
| 1034    | <i>Intentionally left blank</i>                                                                                                                                                                                                                                                                                                                                |
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| 1039    | Dkt. 1-5, Exh. 5 To Complaint, <i>Credo Semiconductor Inc. et al. v. Amphenol Corp.</i> , No. 2:25-cv-00296 (E.D. Tex. Mar. 13, 2025)                                                                                                                                                                                                                          |
| 1040    | <i>Intentionally left blank</i>                                                                                                                                                                                                                                                                                                                                |
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| 1043    | <i>Intentionally left blank</i>                                                                                                                                                                                                                                                                                                                                |
| 1044    | Liu, Jin and Xiaofeng Lin, “Equalization in high-speed communication systems.” <i>IEEE Circuits and Systems Magazine</i> , vol. 4, no. 2, 2004, pp. 4-17 (“Liu”)                                                                                                                                                                                               |
| 1045    | Hsieh, Ming-ta and Gerald E. Sobelman, “Architectures for multi-gigabit wire-linked clock and data recovery.” <i>IEEE Circuits and Systems Magazine</i> , vol. 8, no. 4, 2008, pp. 45-57 (“Hsieh”)                                                                                                                                                             |

## MANDATORY NOTICES

### **A. Real Party-In-Interest**

Petitioner Volex plc. is a real party-in-interest to this proceeding under 37 C.F.R. §42.8(b)(1).

### **B. Related Matters**

A decision in this proceeding could affect or be affected by the following. U.S. Patent No. 11,012,252 (“the ’252 Patent”) is currently the subject of a filed petition for *inter partes* review as set forth in Section B.1; it is currently asserted in actions listed in Section B.2; and infringement of the ’252 Patent is also alleged in the action in Section B.3.

#### **1. United States Patent and Trademark Office**

The ’252 Patent issued from application ser. no. 16/539,910, filed August 13, 2019, and purports to claim priority to Chinese Foreign Application no. 201910155535.9, filed on March 1, 2019. Amphenol Corporation (“Amphenol”) has requested *inter partes* review of the ’252 Patent in IPR2025-00834, having a filing date accorded of April 10, 2025.

#### **2. United States District Court**

##### **a. Eastern District of Texas**

*Credo Semiconductor Inc. et al. v. Volex PLC*, No. 2:25-cv-00298 (E.D. Tex.), filed March 13, 2025 (the “Texas Litigation”).

*Credo Semiconductor Inc. et al. v. Amphenol Corp.*, No. 2:25-cv-00296

(E.D. Tex., filed March 13, 2025 (the “Amphenol Litigation”).

*Credo Semiconductor Inc. et al. v. TE Connectivity PLC*, No. 2:25-cv-00297

(E.D. Tex.), filed March 13, 2025 (the “TE Connectivity Litigation”).

**b. District of Delaware**

*Credo Semiconductor Inc. et al. v. Molex, Inc.*, No. 1:25-cv-00316 (D. Del.),

filed March 13, 2025 (the “Molex Litigation”).

**3. United States International Trade Commission**

*In re Certain Active Electrical Cables and Components Thereof*, Inv. No.

337-TA-3814, complaint filed March 13, 2025.

**C. Counsel and Service Information - §§42.8(b)(3) and (4)**

|                     |                                                                                                                                                                                                                                                                          |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lead Counsel        | Eric S. Lucas, Reg. No. 76,434                                                                                                                                                                                                                                           |
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A power of attorney is submitted with the Petition. Counsel for Petitioner consents to service of all documents via electronic mail.

Petitioner Volex plc (“Petitioner”) requests *inter partes* review and cancellation of claims 1-14 (“Challenged Claims”) of U.S. Patent No. 11,012,252 (EX1001, “the ’252 Patent”).

As discussed above, Amphenol has filed a petition for *inter partes* review of the ’252 Patent (IPR2025-00834). Other than typographical/citation edits, edits to the section on discretionary denial, and edits associated with the retention of a different expert, this petition is substantially the same as Amphenol’s petition. Petitioner’s intention is—to the extent that the Board institutes *inter partes* review based on Amphenol’s petition—to, upon institution, file a motion to join that proceeding as an understudy.

## **I. INTRODUCTION**

The ’252 Patent concerns an active Ethernet cable—such as high data rate cables connecting routers and servers in a server farm—and methods used by transceivers at either end of the cable to process communication signals.

The claims issued with minimal examination. A first office action rejected independent claims but identified as allowable certain dependent claims reciting active cable transceivers using “*fixed, cable-independent, equalization parameters*” with certain signal processing functionality concerning signals transmitted to or received from an electronic device (*e.g.*, server, router). Those claims, rewritten in independent form, then issued with the remaining Challenged Claims.

The claims should never have issued. The allegedly inventive functionality was described in the literature and data sheets published long before the Patent Owner filed the '252 Patent.

The Examiner found (and Patent Owner did not dispute) that Lugthart-993 teaches everything in the independent claims except “*fixed, cable-independent, equalization parameters*”—which Aronson teaches. **Ground 1** shows that Lugthart-993, in view of Aronson, renders every Challenged Claim obvious.

**Ground 2** shows that the claimed functionality had already been commercialized: Tang, in view of a Texas Instruments data sheet and Aronson, renders obvious every independent claim and several dependent claims.

Accordingly, Petitioner requests that the Board institute *inter partes* review and cancel the Challenged Claims.

## **II. STANDING CERTIFICATION**

Petitioner certifies that the '252 Patent is available for *inter partes* review and that Petitioner is neither barred nor estopped from requesting *inter partes* review of the Challenged Claims. 37 C.F.R. §42.104(a).

## **III. UNPATENTABILITY GROUNDS**

The Challenged Claims are unpatentable as follows:

| Ground | References              | Claims          | Post-AIA Basis |
|--------|-------------------------|-----------------|----------------|
| 1      | Lugthart-993+Aronson    | 1-14            | §103           |
| 2      | Tang+TI-Retimer+Aronson | 1-4, 6-9, 11-14 | §103           |

The '252 Patent's earliest possible effective-filing date is March 1, 2019.

EX1001, code (30). Each relied-upon reference is post-AIA §102(a)(1) prior art even under the earliest March 2019 effective-filing date.

| Name                  | Filing Date | Issue/Publication Date |
|-----------------------|-------------|------------------------|
| Lugthart-993 (EX1005) | 2014-12-23  | 2016-05-10             |
| Aronson (EX1006)      | 2008-10-31  | 2010-07-27             |
| Tang (EX1007)         | 2011-11-09  | 2013-05-09             |
| TI-Retimer (EX1008)   |             | 2017-03-06             |

#### IV. '252 PATENT

##### A. Background<sup>1</sup>

The '252 Patent has 14 claims. Claims 1, 6, and 11 are independent.

Appendix A provides a claim list labeling limitations (e.g., "[1.A]").

The '252 Patent concerns active electrical cables—which Patent Owner ("PO") calls active ethernet cables ("AEC")—that connect host devices (e.g., computers). EX1001, 3:44-48, 5:6-9. The AEC ends have "connectors" that a

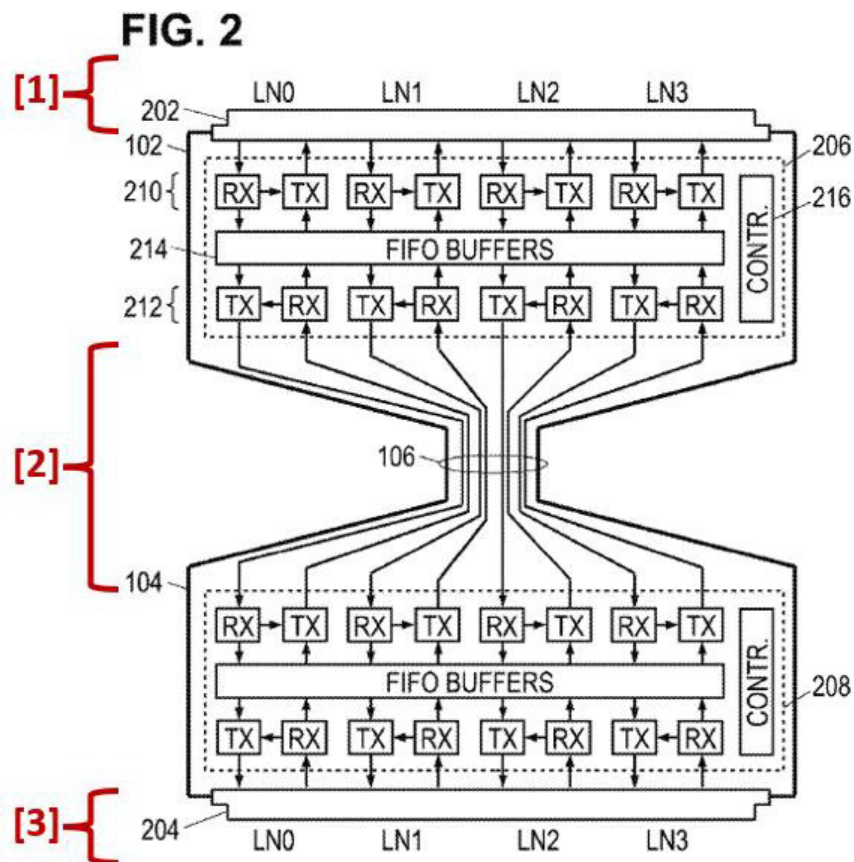
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<sup>1</sup> Unless otherwise noted all emphasis in the Petition (including figure annotations) is added.

host device's mating port receives, each connector comprising a transceiver (*i.e.*, a transmitter/receiver) that processes signals transmitted into and out of the cable.

EX1001, 1:29-42; Lugthart-993, 14:3-8. EX1003, Declaration of Ayman Fayed, Ph.D. ("Fayed"), ¶¶58-61 (Ethernet cables comply with the Ethernet standard).

Each connector's transceiver splits a link between two hosts into three segments: [1] from the first host to the first transceiver; [2] between the first transceiver and the second transceiver (over the cable); and [3] between the second transceiver and the second host. EX1001, Fig. 2 (below). Fayed, ¶¶72-73.

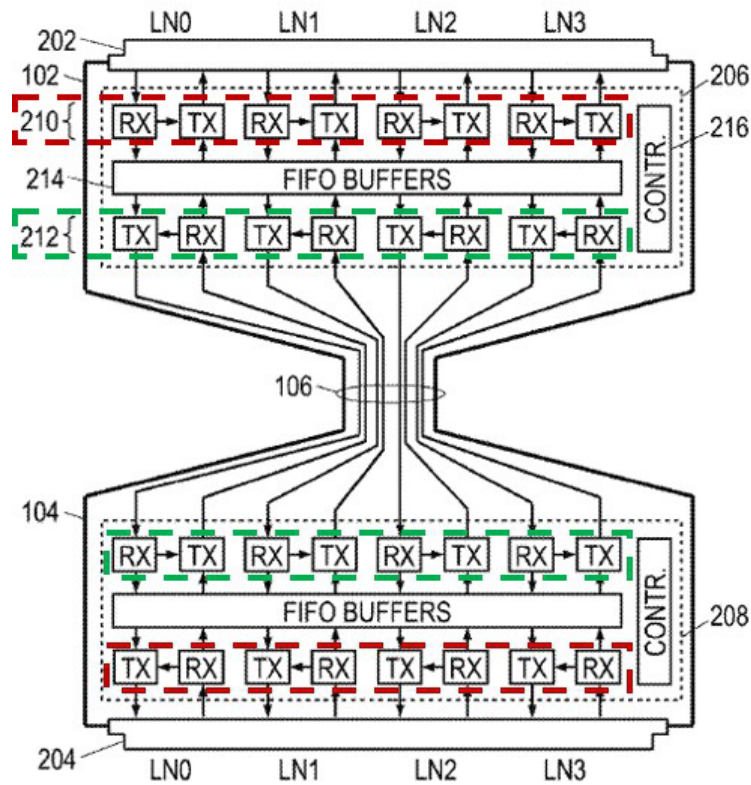


Each transceiver [1] receives a signal from its host, and [2] demodulates, processes, and remodulates it for transmission over the cable. A distal cable end's

receiving transceiver performs similar steps on data received from the cable, which it [3] transmits to the receiving transceiver's host interface. In the '252 Patent, each connector's transceiver performs equalization and "clock and data recovery (CDR) and re-modulation of data streams [passing] in each direction" along the link between two host devices, including at the interfaces to the host devices and over the cable. EX1001, 3:65-4:26. The CDR placement enables transceivers to separately address signal degradation/distortion over each link segment rather than the aggregate degradation/distortion over the entire link. Fayed, ¶¶73-74.

The transceivers use "equalization parameters" including transmitter pre-equalizer "filter coefficient values" and receiver "gain and filter coefficient values[.]" EX1001, 4:60-5:5. The "host-facing transmitter and receiver set 210 employ fixed equalization parameters that are cable-independent" while "[t]he center-facing transmitter and receiver set 212" that transmits/receives over the cable's conductors "employ[s] cable-dependent equalization parameters" that "may be adaptive or fixed." EX1001, Fig. 2 (below), 4:60-5:5. Fayed, ¶¶62, 75.

**FIG. 2**



Signal equalization (“pre-emphasis” for outgoing transmissions) may minimize undesirable channel or signal degradation/distortion on transmitted signals—*e.g.*, inter-symbol interference (ISI). EX1001, 6:57-7:3, 7:53-56. POSAs were familiar with degradation/distortion like ISI and other effects, *e.g.*, jitter. EX1001, 4:20-21; Fayed, ¶¶74-75, 84-90. POSAs knew that signal processing components, including CDRs and equalizers, could address degradation/distortion and ensure that a digital signal recovered from a received signal approximated the transmitted digital signal. Fayed, ¶¶74-76, 84-105.

## **B. Prosecution History**

The Examiner indicated as-filed dependent claims 3-7, 10-14, and 17-20 were allowable in a first office action, but rejected the remaining claims as anticipated by Lugthart-993. EX1002, 192-199. The allowable subject matter required fixed cable-independent equalization parameters for processing the host-facing data streams. *Id.*, 210-217. The applicant canceled the rejected claims and amended as-filed claims 3, 10, and 17 (which issued as independent claims 1, 8, and 15) to incorporate the rejected independent claim limitations. *Id.* The claims were allowed. *Id.*, 227-233.

## **C. POSA**

On March 1, 2019, a person having ordinary skill in the art (“POSA”) would have had a Bachelor of Science in electrical or computer engineering with at least three years of experience in digital communication system design. A higher level of education may substitute for less experience. Fayed, ¶¶50-57.

## **V. CLAIM INTERPRETATION**

As discussed in more detail where relevant below, claim terms are construed herein using the standard used in civil actions under 35 U.S.C. §282(b), in accordance with the ordinary and customary meaning as understood by a POSA and the patent’s prosecution history. 37 C.F.R. 42.100(b). No outer-boundary constructions are required because the claims are unpatentable under any reasonable construction as detailed below.

## VI. GROUND 1: LUGTHART-993+ARONSON RENDERS OBVIOUS CLAIMS 1-14

The Examiner found that Lugthart-993 anticipated the as-filed independent application claims—reciting everything except “*fixed, cable-independent, equalization parameters*” (e.g., [1.E], [6.K], [11.D.ii]). EX1002, 194-198. Patent Owner (“PO”) never disputed the anticipation rejections, but canceled the rejected claims and rewrote the dependent claims with “*fixed, cable-independent, equalization parameters*” to include the rejected claims’ limitations. *Id.*, 210-217. As shown below, the Office correctly determined that Lugthart-993 meets every independent claim limitation except the “*fixed, cable-independent, equalization parameters*,” which Aronson teaches. Lugthart-993+Aronson renders every claim obvious.

### A. Lugthart-993

Lugthart-993 discloses an “active cable” 110 comprising “transceiver assemblies 105a, 105b positioned at either end of... conductive lines 111.” Lugthart-993, 14:3-26, Fig. 2A (below).

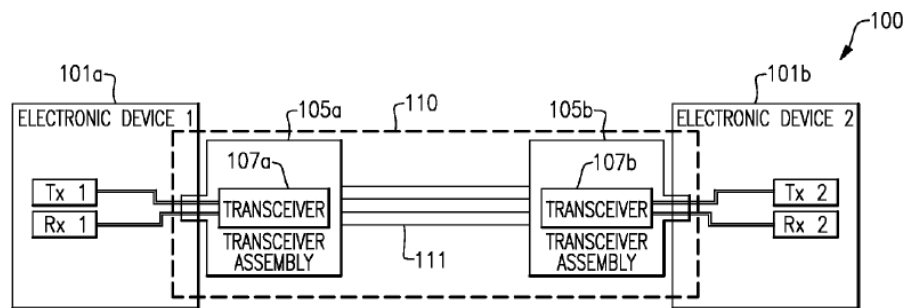


**FIG. 2A**

Conductive lines 111 can be micro coaxial cable conductors. Lugthart-993, Figs. 3A-3B, 17:9-18:42. Cable 110 interconnects electronic devices 101a/101b (“host devices”), with transceivers 107a/107b in transceiver assembly 105a/105b communicating signals on its “host side” and “line side.” Lugthart-993, 13:49-14:26; *see also id.*, Fig. 4A. Fayed, ¶¶117-118.

Lugthart-993 Figure 1A transceiver 10 processes data transmitted through “EGRESS/TRANSMIT” (from host to line/cable) and “INGRESS/RECEIVE” (from line/cable to host)<sup>2</sup> paths. Lugthart-993, 7:49-8:14.

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<sup>2</sup> Lugthart-993’s labels INGRESS/EGRESS from the *host’s* perspective, whereas the ’252 Patent labels *inbound/outbound* paths from the *cable’s* perspective.

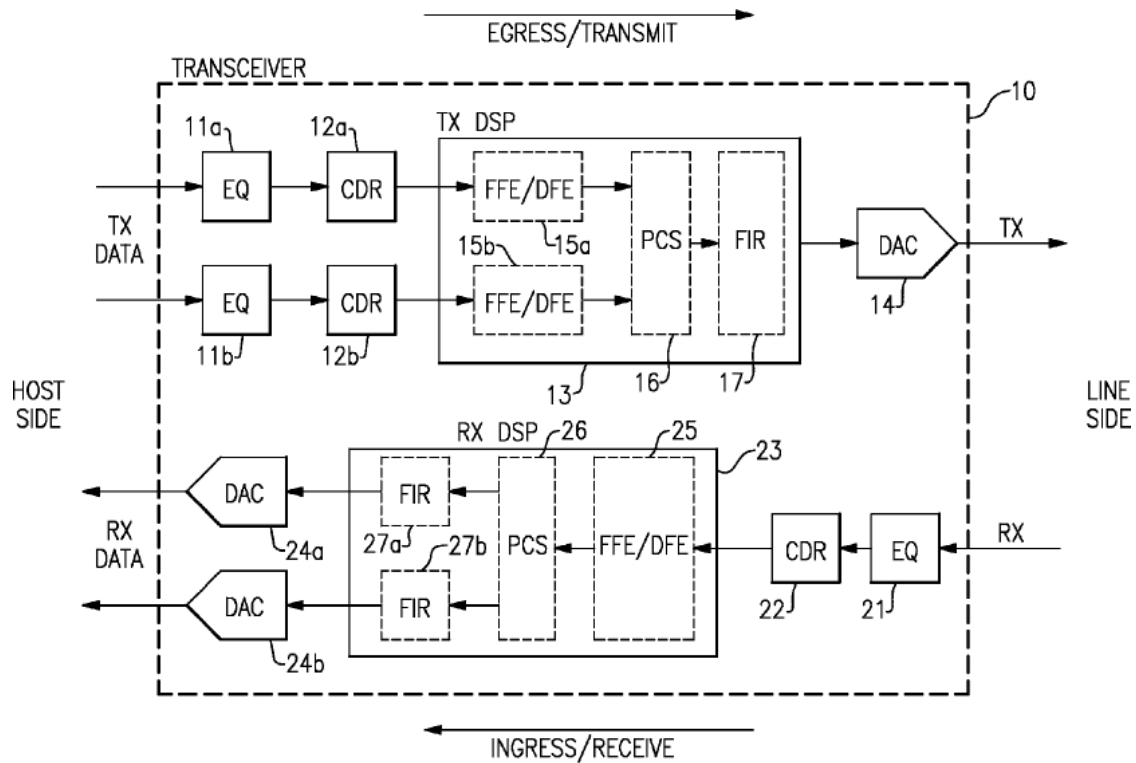


**FIG.1A**

In the EGRESS / TRANSMIT path, equalizers 11a/11b receive host-side transmit data (TX DATA) and perform “equalization to compensate for transmission line losses on the host side.” Lugthart-993, 7:63-67, 8:60-62. Fayed, ¶¶119-120.

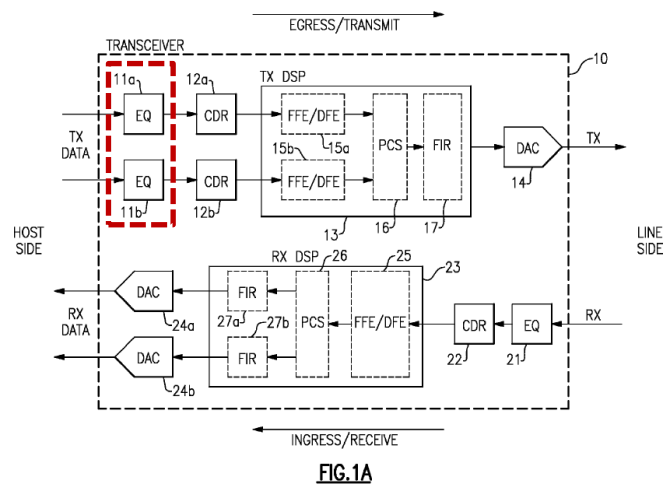
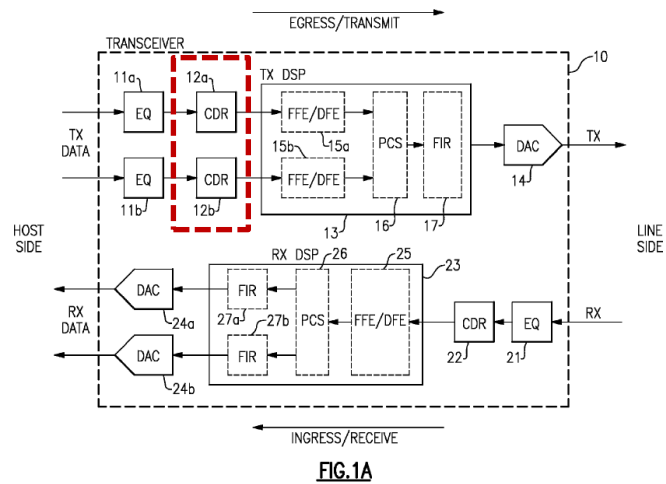


**FIG.1A**

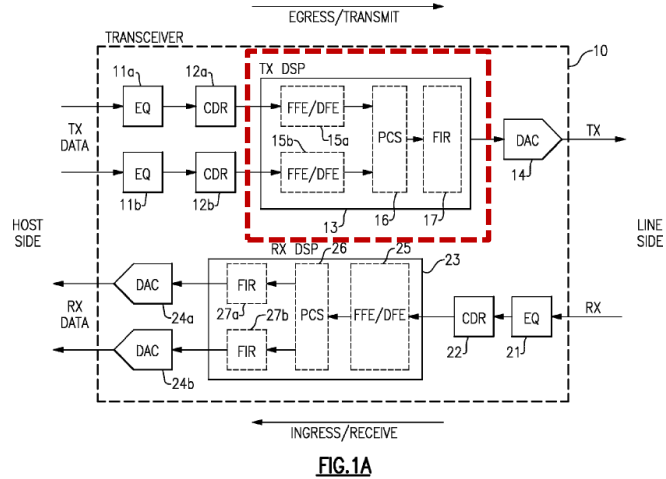
## CDR circuits 12a/12b

“recover data in data streams generated by... transmit path equalizers [11a/11b].” Lugthart-993, 7:63-67, 9:15-18. Fayed, ¶120.



## Digital signal processor

(DSP) 13 has feed-forward equalizer (FFE) and/or decision feedback equalizer (DFE) 15a/15b, physical coding sublayer (PCS) block 16, and finite impulse response (FIR) filter 17 (“FIR 17”). Lugthart-993, 7:67-8:2, 9:19-31. Fayed, ¶120.



PCS block 16 combines multiple parallel NRZ-encoded channels into a single PAM-4-encoded channel. Lugthart-993, 23:4-19; Fayed, ¶95. FIR 17 pre-

equalizes the signal by pre-compensating for line-side channel distortion.

Lugthart-993, 21:42-46; 23:20-30. Fayed, ¶¶123.

Equalizer 21, CDR 22, and DSP 23 perform analogous functions on the INGRESS / RECEIVE path. Lugthart-993, 7:49-8:14, 8:58-10:8, 23:31-43; Fayed, ¶¶124-125. Equalizer 21 compensates for line-side transmission line losses. Lugthart-993, 8:58-67; Fayed, ¶¶124-125.

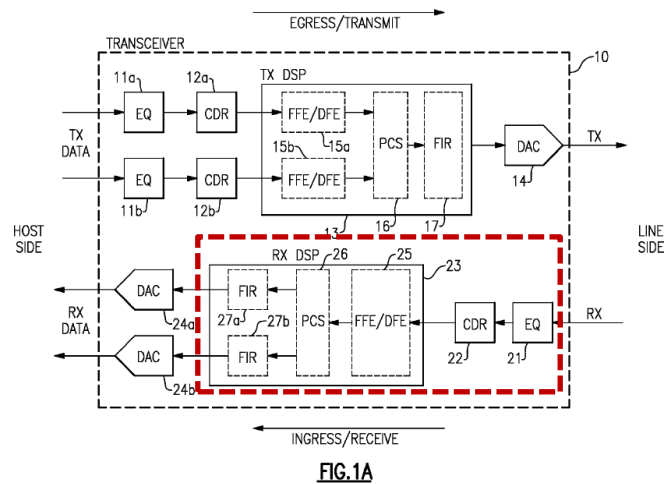


Figure 10 (below) illustrates CDR system 500's CDR circuit 502 as used in the transceivers in, *e.g.*, Figures 1A-2B. Lugthart-993, 34:29-43.

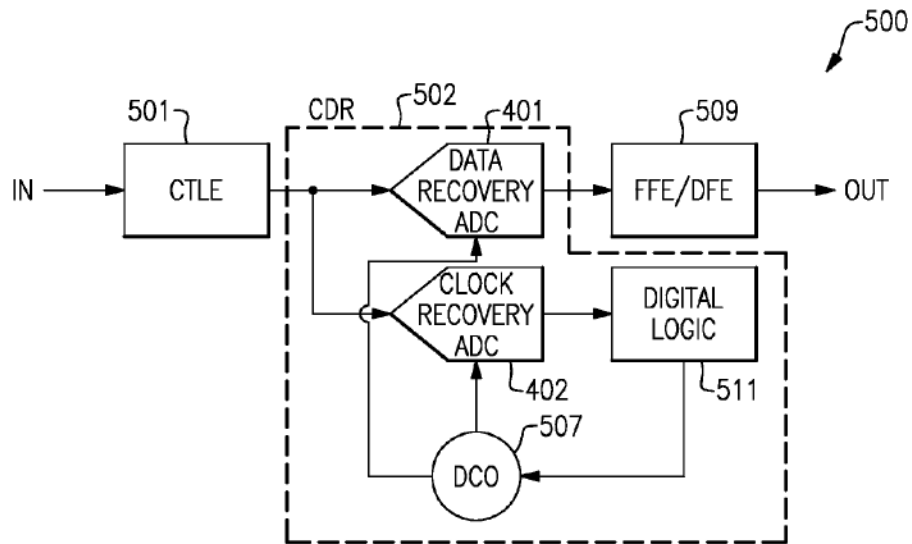


**FIG.10**

CTLE 501 equalizes analog input signal IN to mitigate distortions from the transmission side—e.g., the *host* for EGRESS/TRANSMIT path, or the *line* for INGRESS/RECEIVE path—after which CDR circuit 502 recovers the clock and data by aligning sample clock signals from oscillator 507 to the input signal and generating a digital representation of the analog input signal. Lugthart-993, 34:54-35:26, 29:45-47. CDR circuit 502 provides the recovered data to FFE/DFE 509, which condition it as output signal OUT. Lugthart-993, 35:27-32; Fayed, ¶¶121-122.

## **B. Aronson**

Aronson discloses an active cable for high-speed transmissions between network nodes. Aronson, Abstract, 1:12-21. While Aronson's title recites an optical cable, Aronson also discloses *copper* twisted-pair or coaxial cables like

Lugthart-993's. Aronson, 1:29-2:23, 7:17-20. Figures 12A-12B (below) illustrate features “incorporated into the ICs in a copper active cable design.” Aronson, 14:16-15:24; Fayed, ¶¶126-127.

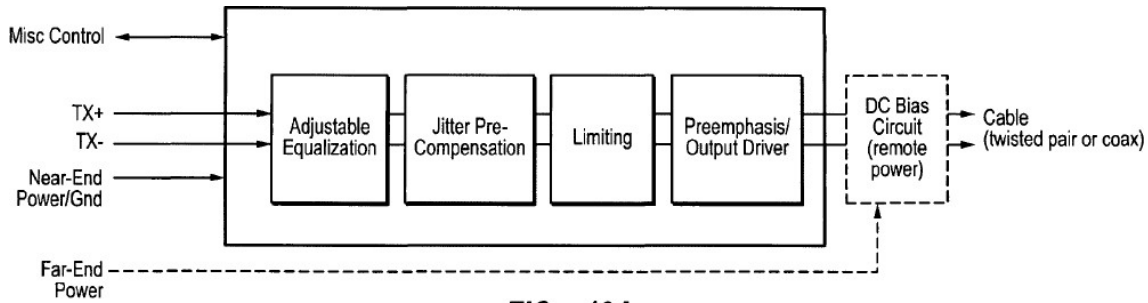


**FIG. 12A**

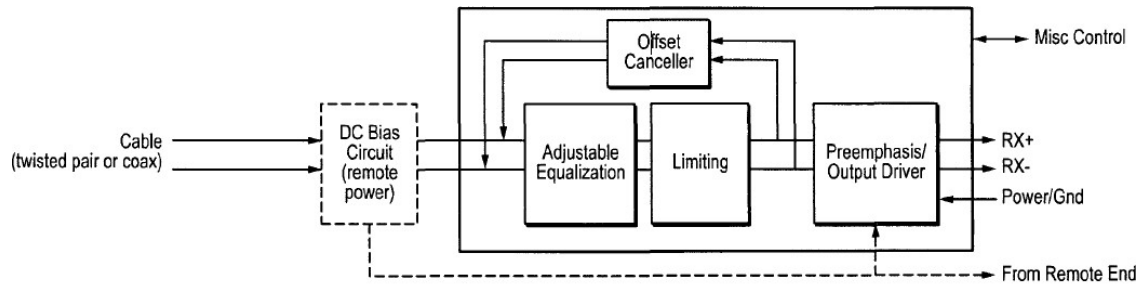


**FIG. 12B**

Figure 12A’s circuit processes TX signals from the host and transmits signals over the cable, where equalization “compensat[es] for high frequency loss in the host board traces,” and pre-equalization overcomes loss on the cable and “match[es]” loss from “the particular length [and] characteristics of the copper cabling.” Aronson, 14:16-43; Fayed, ¶¶128-129.

Figure 12B’s circuit handles dataflow in the other direction: it receives RX signals from the cable, performs equalization “to compensate for” cable losses, and—before transmitting to the host—performs pre-emphasis to “overcome high

frequency losses on long [host-side] PCB traces.” Aronson, 15:1-6, 15:17-24; Fayed, ¶129.

Signal pre-emphasis and/or equalization can be “fixed, adjustable, or adaptable.” Aronson, Abstract, 14:19-23, 14:33-34, 15:1-8, 15:17-23; Fayed, ¶130.

### **C. Lugthart-993+Aronson Combination**

The Challenged Claims recite well-known concepts including that—with CDR circuits in an active cable transceiver—the link between hosts has three segments (two host interfaces and a cable) for which: (1) equalization in the cable segment uses cable-dependent parameters, while (2) equalization at the host interfaces uses cable-independent parameters. The claims also recite the well-known concepts that equalization parameters can be fixed or adaptive.

To the extent Lugthart-993 is considered to not expressly disclose any such claimed requirements, Aronson—and other references corroborating a POSA’s background knowledge—expressly disclose all these claimed requirements and would have given POSAs reasons to have implemented Lugthart-993 in view of Aronson (hereinafter “Lugthart-993+Aronson”) in a manner meeting every Challenged Claim. Fayed, ¶131.

#### **1. Fixed Cable-Independent Parameters for Host-Side Equalization**

On the EGRESS/TRANSMIT path, Lugthart-993’s transceivers equalize the signals conveying inbound data stream TX, using equalizers 11a/11b, to

“compensate for transmission line losses on the *host* side.” Lugthart-993, 8:58-9:5, Fig. 1A (below); *infra* §VI.D.5 ([1.C]); Fayed, ¶132.

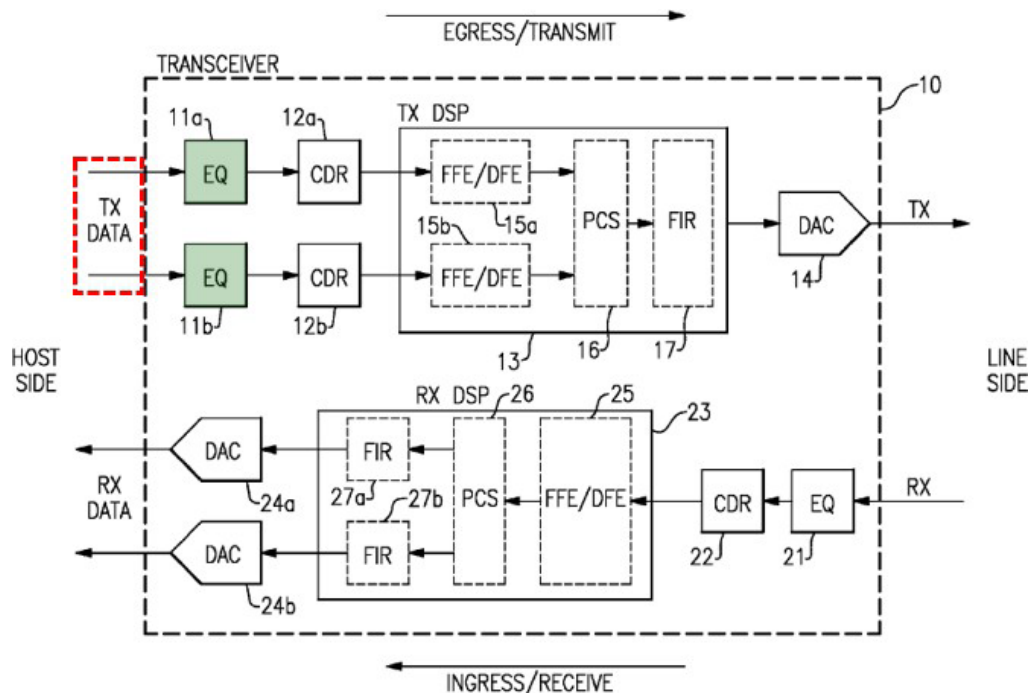


**FIG.1A**

On the INGRESS/RECEIVE side, DSP 23’s FIR filters 27a/27b (“FIRs 27a/27b”) pre-equalize the signals conveying outbound data stream RX, thereby pre-compensating for the *host-side* distortion/losses on a line-side data stream that was already equalized for line-side losses by equalizer 21 Lugthart-993, 8:58-60; §§VI.D.5-6 ([1.C]-[1.D]) *infra*; Fayed, ¶133.

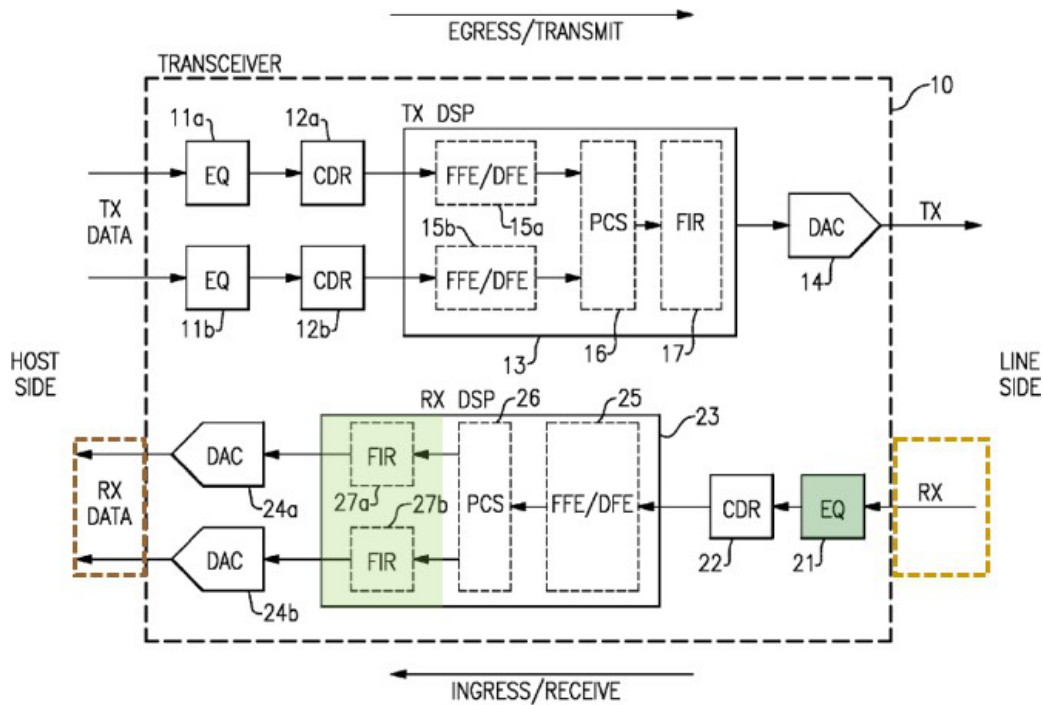


**FIG.1A**

### ***cable-independent parameters***

Because the CDR functionality recovers signals *before* cable-side output via CDRs 12a/12b and FFE/DFEs 15a/15b on the EGRESS/TRANSMIT path (§VI.D.5 *infra*), and via CDR 22 and FFE/DFE 25 (§VI.D.6 *infra*) *after* cable-side reception on the INGRESS/RECEIVE path, POSAs understood that, for equalizers 11a/11b and FIRs 27a/27b to compensate for *host-side* distortion/losses, each would employ equalization parameters based on the host interface characteristics and not on a line-side cable’s characteristics (from which they are separated by CDR processes), such that they would be “*cable-independent*” per the ’252 Patent. Fayed, ¶134.

To the extent Lugthart-993 is considered to not expressly teach or suggest using *cable-independent* parameters for pre-equalizing and equalizing signals to and from the host, Aronson does.

The cable's transmitter Integrated Circuit (IC) in Aronson Figure 12A (below) performs *cable-independent* equalization on inbound data stream TX+/TX- to “compensat[e] for high frequency loss in the *host board traces*.”

Aronson, 14:16-23. Host board traces are independent of the cable; therefore, parameters compensating for them are *cable-independent*. Fayed, ¶136.

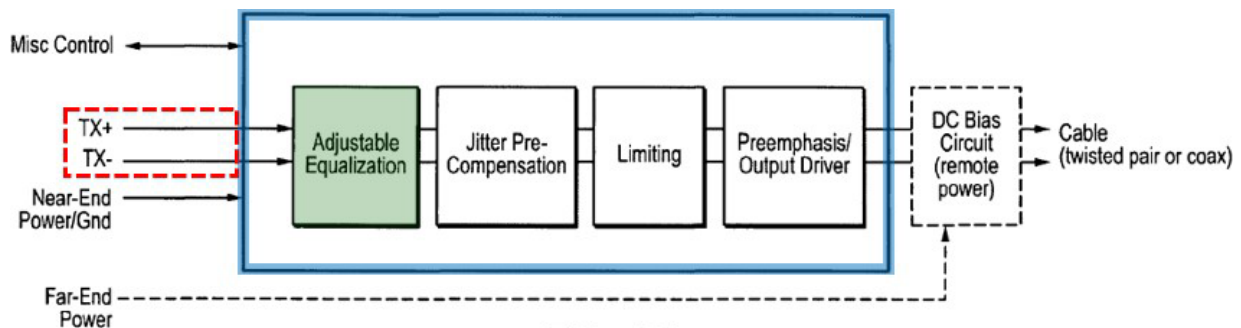


FIG. 12A

Aronson's PCB traces are on the host (Aronson, 15:1-8 (“host PCB traces”)); therefore, pre-equalization parameters addressing them are *cable-independent*. Fayed, ¶137.

Aronson's teachings to use *cable-independent* parameters to perform equalization compensating for *host-side losses* gave POSAs reason to implement Lugthart-993 in the same manner. Fayed, ¶138.

### *fixed parameters*

Aronson also teaches that these cable-independent parameters are *fixed*.

While Figure 12A shows “adjustable” equalization, “[s]uch equalization could be *fixed*.” Aronson, 14:20-23; Fayed, ¶¶135-136.

The cable’s receiver IC generates outbound data stream RX+/RX- to the host by, *inter alia*, performing equalization in a pre-emphasis/output driver that drives “*host PCB traces*.” Aronson, Fig. 12B (below), 15:1-8. Pre-equalizing outbound stream RX+/RX- addresses “losses on *long PCB traces*” and “could be *fixed*.” Aronson, 15:17-24.

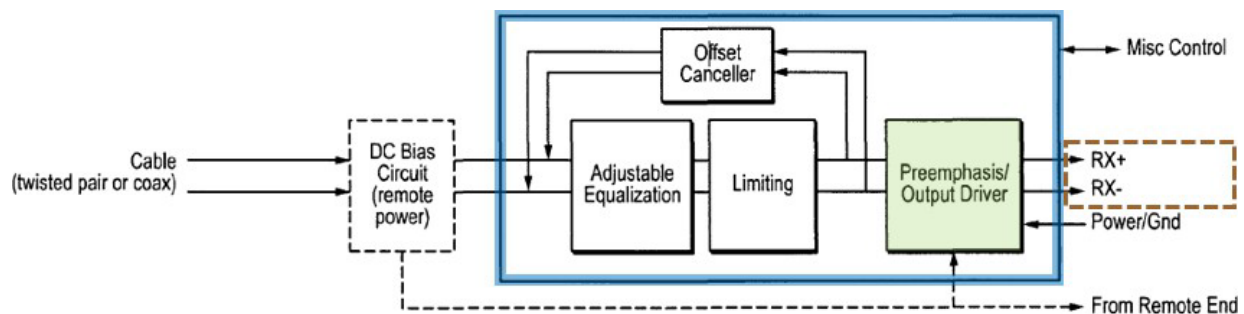


FIG. 12B

POSAs understood that the design choice between fixed or adaptive equalization involved tradeoffs between, e.g, accuracy, speed, manufacturing cost, and complexity, when equalizing a communication channel like an active copper cable’s host interface. Aronson, 15:17-24. “Fixed” parameters reduced complexity and manufacturing costs. Fayed, ¶139 (discussing tradeoffs); EX1016, 1:7-18 (discussing slow convergence with adaptive equalization); EX1011, [0009]-[0011]

(discussing tradeoffs between fixed and adaptive equalization); EX1017, 1:52-55 (large gate count for adaptive equalization can cause “high chip costs”); EX1014, [0034] (“The adaptive equalizer can be trapped in a failure state (i.e., incorrect state) and not able to recover from the failure state.”); EX1024, [0058] (“[E]qualization techniques... come with different engineering tradeoffs, including trade-offs in power consumption, performance, and/or cost.”).

A POSA’s background knowledge of these tradeoffs between fixed and adaptive parameters would have given POSAs additional reasons—beyond Aronson’s specific teaching to use fixed parameters—to make the design choice to fix the cable-independent equalization parameters in Lugthart-993’s equalizers 11a/11b and DSP 23’s FIRs 27a/27b. Fayed, ¶140.

The ’252 Patent says the cable-independent parameters are fixed “[i]n *at least some* contemplated embodiments.” EX1001, 4:60-64. Thus, the cable-independent parameter need not be fixed in all embodiments. There is nothing critical or inventive about fixing the cable-independent parameters—the inventors claimed one of the known, obvious, design choices. Fayed, ¶141. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007) (obvious to pursue finite number of identified predictable solutions).

Using fixed cable-independent parameters to perform Lugthart-993’s equalization (in equalizers 11a/11b and FIRs 27a/27b) that compensates for host-

side losses also meets a rationale indicative of obviousness. *KSR*, 550 U.S. at 417-418. This combines no more than prior art elements [Luthgart-993’s host-side equalization; Aronson’s teaching to use fixed cable-independent parameters for host-side equalization] according to known methods to yield predictable results [equalizing Luthgart-993’s host-side signals using fixed cable-independent parameters]. Fayed, ¶142.

## **2. Cable-Dependent Parameters for Line-Side Equalization**

Lugthart-993’s DSP 13 uses FIR 17 to “perform [pre-]emphasis on the signal to compensate for channel losses” over the cable (e.g., on the transceiver’s line-side). Lugthart-993, 23:4-30, Fig. 1A (below). Lugthart-993’s equalizer 21 “provide[s] signal equalization to compensate for transmission line losses on the line side.” Lugthart-993, 8:58-9:5; *see also* 22:4-9 (compensates for losses “over the cable”). POSAs understood that FIR 17 and equalizer 21 use “cable-dependent” parameters because they compensate for degradation/distortion over the cable (e.g., “line side”). Fayed, ¶143.

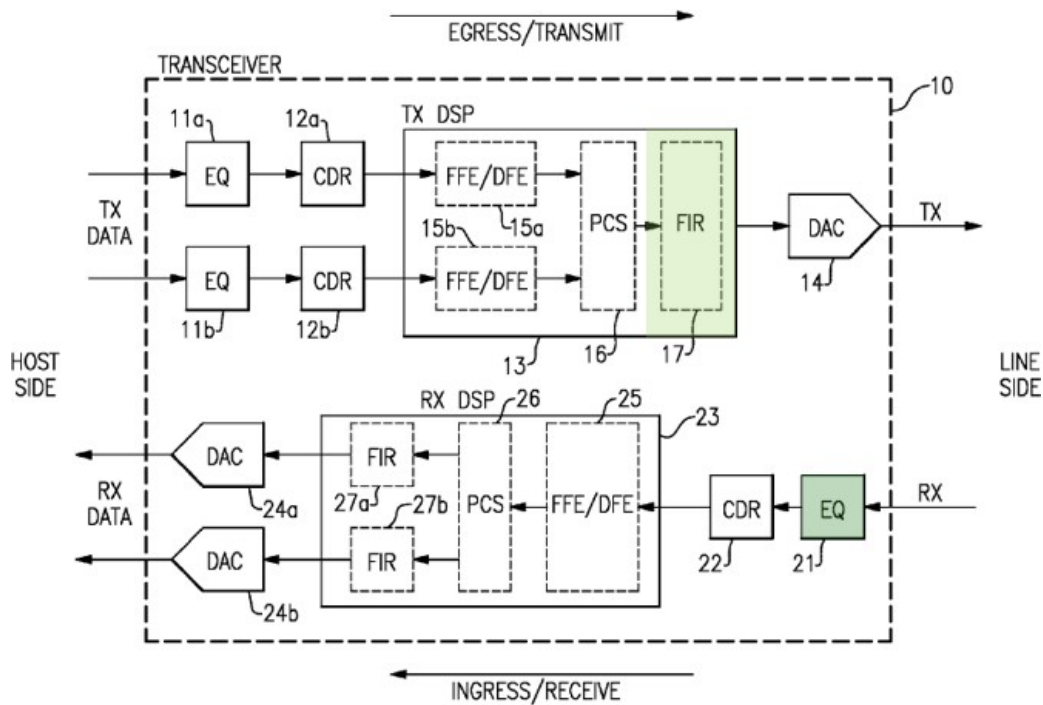


**FIG.1A**

To the extent that Lugthart-993 is considered to not explicitly describe the equalization parameters used by FIR 17 and equalizer 21 as *cable-dependent*, Aronson confirms that would have been the conventional and obvious way to implement Lugthart-993’s equalization addressing cable-side losses. Aronson’s transmitter IC’s line-side pre-emphasis/output driver overcomes “loss on the cable” using cable-dependent parameters that “match the particular length [and/or] the characteristics of the copper cabling.” Aronson, 14:33-43, Fig. 12A (below). Similarly, Aronson’s receiver IC equalizes received line-side signals to “compensat[e] for the cable” losses using cable-dependent parameters based on “cable length and characteristics.” Aronson, 15:1-8, Fig. 12B (below); Fayed, ¶144.

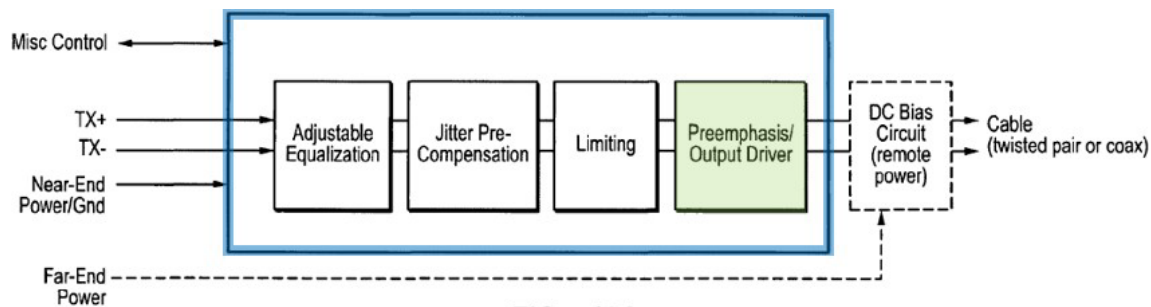


**FIG. 12A**

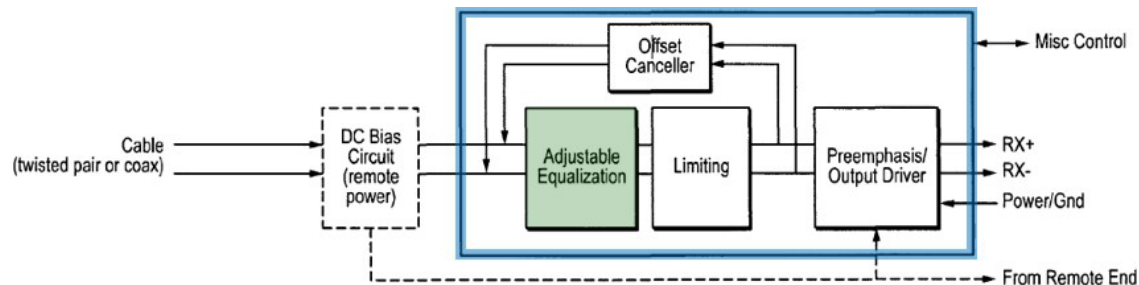


**FIG. 12B**

Aronson's express teachings to use cable-dependent parameters to equalize signals that the cable transceiver transmits to, and receives from, the cable gave POSAs reason to implement Lugthart-993 using cable-dependent equalization parameters in the same manner. Doing so was nothing more than combining prior art elements [Lugthart-993's line-side equalization; Aronson's teaching to use cable-dependent parameters for line-side equalization] according to known methods to yield predictable results [equalizing Lugthart-993's line-side signals using cable-dependent parameters]. *KSR*, 550 U.S. at 417-418; Fayed, ¶145.

Aronson describes a known design choice to set equalization parameters by fixing them or using an adaptive scheme. Aronson, 15:1-6; Fayed, ¶146. As explained below, POSAs had reasons to use either alternative. Fayed, ¶¶147-158.

### a. Adapting The Line-Side Cable-Dependent Parameters

POSAs knew that equalization parameters could be adapted by adjusting them based on distortions to known training signals transmitted over the cable. Fayed, ¶¶74-76. Lugthart-993 describes training phases during which the cable-dependent equalization parameters for DSP 13's FIR 17 and equalizer 21 are adapted as discussed *infra* §VI.F (claim 3). To the extent Lugthart-993 is considered to not teach expressly that the equalization coefficients for DSP 13 and equalizer 21 are among the parameters adapted during Lugthart-993's training phases, POSAs had reasons to implement Lugthart-993 in this manner based on Aronson and a POSA's background knowledge of the benefits of adapting equalization parameters. Fayed, ¶147.

Aronson explains that “pre-emphasis and/or equalization can be fixed, adjustable, or *adaptable*.” Aronson, Abstract. While Aronson's Abstract refers to an optical cable embodiment, POSAs understood that adaptation applies equally to Aronson's copper cable embodiments, as in Figs. 12A-12B. Aronson, 3:62-65; 14:16-15:24; Fayed, ¶¶130, 148. Indeed, Aronson is explicit that adjustable equalization in Figure 12B (below) that “compensate[s] for the cable” losses can be “adaptive.” Aronson, 15:1-7 (describing adjustable factory-set equalization as of “particular interest” because cable characteristics are established at manufacture, but disclosing an “adaptive” equalization alternative).

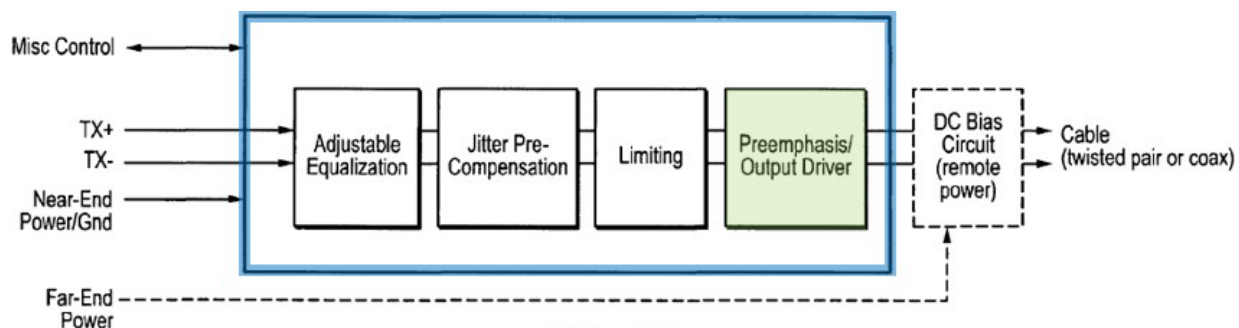


FIG. 12A

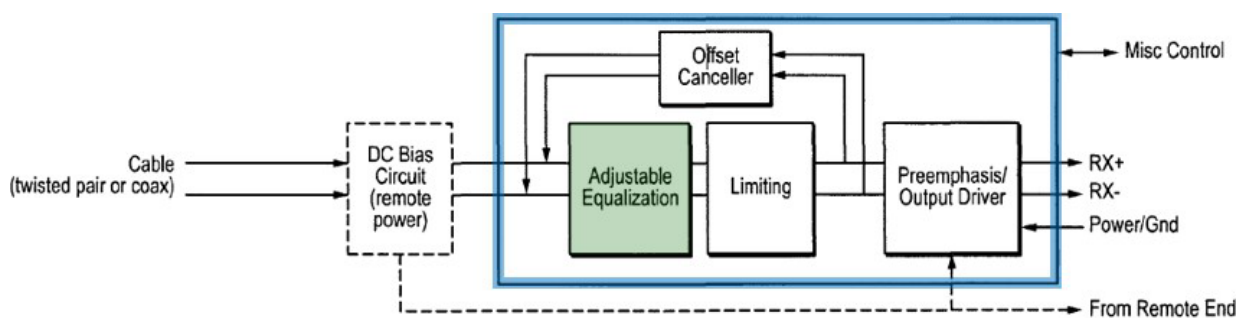


FIG. 12B

POSAs understood that pre-equalization by Figure 12A's pre-emphasis/output driver is “adaptive” given Aronson’s teachings that “pre-emphasis... can be... *adaptable*” (Aronson, Abstract), and that adaptive equalization can similarly be used for line-side losses (Aronson, 15:1-7). Fayed, ¶¶130, 149.

Aronson’s teaching adapting cable-dependent equalization parameters gave POSAs reason to make the design choice to adapt the cable-dependent equalization parameters for Lugthart-993’s DSP 13’s FIR 17 and equalizer 21 during Lugthart-993’s training phases. Fayed, ¶150.

A POSA’s knowledge of the benefits of using adaptive cable-dependent parameters in active copper cables like Lugthart-993’s and Aronson’s—including

better distortion compensation yielding better signal quality and lower error rates—gave POSAs additional reasons to make the design choice to make the cable-dependent parameters in Lugthart-993’s FIR 17 and equalizer 21 adaptive during Lugthart-993’s training phases. Lugthart-993, 47:56-48:27; Fayed, ¶151; EX1017, 1:39-51 (adaptive equalization yields “[b]etter signal quality and lower bit error rates” than “static equalization”); EX1015, [0027] (“Adaptive transmit equalization enables enhanced performance compared to fixed equalization,” can support “a broader range of cable lengths” and “tolerances,” can “simplif[y] receiver design,” and “may save [transmitter] power... by using power back-off,” compared to fixed transmit equalization or receiver equalization).

It was known that environmental conditions like temperature, bending and vibration can impact signal transmission through a cable and that adaptive equalization compensated for such environmental conditions that may differ from a factory-testing environment. Fayed, ¶152; EX1024, [0057] (ISI changes over time based on environmental conditions like temperature, physical bending, vibrations); EX1018, 2:5-11, 3:16-17 (adaptive equalization can compensate variations in channel distortion from changes in humidity, temperature, and power); EX1017, 1:39-51 (“Conventional adaptive equalization... is... better able to compensate for unpredictable and time-dependent distortion [than static equalization].”). POSAs understood that these environmental conditions (e.g., bending) may have a greater

impact on the cable than on host traces and thus lead a POSA to choose adaptive cable-dependent parameters while choosing fixed cable-independent parameters for host-side losses as described *supra* §VI.C.1. Fayed, ¶152.

Using fixed (rather than adaptive) cable-dependent parameters was also a known obvious alternative as discussed *infra* §VI.C.2.b. Demonstrating obviousness of either alternative does not require showing that one was a better option than the other—only that each was a known suitable option. *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 800 (Fed. Cir. 2021) (“It’s not necessary to show that a combination is the best option, only that it be a suitable option.”) (cleaned up). The inventors’ claiming both known alternatives does not render either non-obvious. *See* claims 3 (“adapt”) and 4 (“fixed”). Fayed, ¶153; *KSR*, 550 U.S. at 421 (obvious to pursue finite number of identified predictable solutions).

Using *adaptive* cable-dependent parameters in Lugthart-993’s FIR 17 and equalizer 21—trained during Lugthart’s training phases—would have been nothing more than combining prior art elements using known methods to yield the predictable results of cable-dependent equalization parameters that better compensate for the cable’s installed environment. *KSR*, 550 U.S. at 417-418; Fayed, ¶154.

**b. Line-Side Cable-Dependent Parameters Determined During Manufacturing-Testing and Fixed During Normal Usage**

As noted *supra* §VI.C.2.a, while Aronson teaches the design choice of adapting the cable-dependent line-side equalization parameters, Aronson is explicit that line-side pre-equalization by the pre-emphasis/output driver—and received line-side signal equalization—in Figures 12A-12B (below) can be determined during manufacturing-testing and then fixed. Aronson, 14:33-39 (Fig. 12A’s pre-equalization can be “adjusted at factory setup”), 15:1-7 (Fig. 12B’s equalization may be “fixed;” “[a]djustable but factory set equalization” is of “*particular interest*”); Fayed, ¶155 (factory set equalization parameters are “fixed during normal usage”).

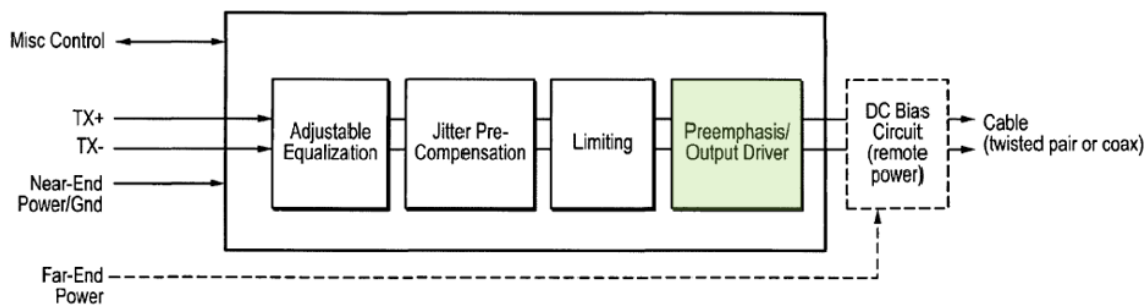


**FIG. 12A**

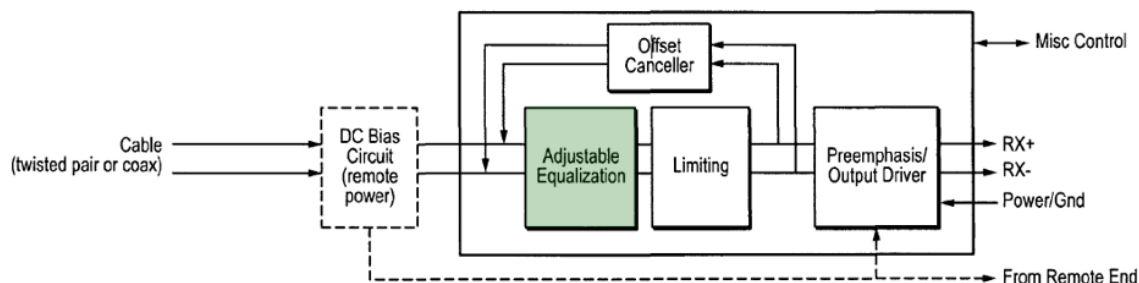


**FIG. 12B**

The known benefits from using fixed parameters—e.g., reducing complexity and manufacturing cost—for equalizing received signals and pre-equalizing transmitted signals for distortion from transmission over a copper cable, as in Lugthart-993 and Aronson, would have given POSAs further reason to make the design choice to fix the cable-dependent parameters in Lugthart’s DSP 13’s FIR 17 and equalizer 21. Fayed, ¶156 (choosing between “fixed” and “adaptive” parameters involves tradeoffs between accuracy and complexity/manufacturing cost); *supra* §VI.C.1 (collecting references discussing tradeoffs, costs, and benefits with using fixed or adaptive equalization parameters in context of cable-independent parameters) *KSR*, 550 U.S. at 421 (obvious to pursue finite number of identified predictable solutions).

Indeed, POSAs understood that factory-set fixed parameters for line-side equalizers are of “*particular interest* because the cable length and characteristics will be established at the time of the cable manufacture.” Aronson, 15:6-8; Fayed, ¶157; EX1014, [0031]-[0032] (fixed parameters optimized for known cable length are simple and reliable).

Fixing the parameters for Lugthart’s FIR 17 and equalizer 21 to values determined during manufacturing-testing would have been nothing more than combining prior art elements, using known methods, yielding the predictable

results of fixed equalization parameters that require less complexity and cost to implement. *KSR*, 550 U.S. at 417-418; Fayed, ¶158.

### 3. Reasonable Expectation of Success

POSAs would have had a reasonable expectation of success in implementing Lugthart-993's transceivers in any and all of the ways discussed *supra* §§VI.C.1-2. As discussed *supra* §§VI.C.1-VI.C.2.b, Lugthart-993 already discloses cable-dependent and cable-independent parameters that POSAs understood can be fixed or adaptive, and every above-discussed design choice was well-known, as demonstrated by Aronson and numerous other references corroborating a POSA's background knowledge. Implementing these techniques was well-known for use in active copper cables like Lugthart-993's was well within a POSA's capabilities. Fayed, ¶159.

#### D. Claim 1

##### 1. Preamble

|       |                                                 |
|-------|-------------------------------------------------|
| 1.PRE | <i>An active Ethernet cable that comprises:</i> |
|-------|-------------------------------------------------|

Lugthart-993+Aronson (*supra* §VI.C) is an active cable 110 including “actively powered componentry.” Lugthart-993, 14:3-5, Fig. 2A (below highlighting cable 110); Fayed, ¶¶160-161. Cable 110 is an *active Ethernet cable* because it is configured to support data communications according to the Ethernet

standard. Lugthart-993, 15:64-16:5 (supports the “gigabit Ethernet” protocol); Fayed, ¶¶160-161.

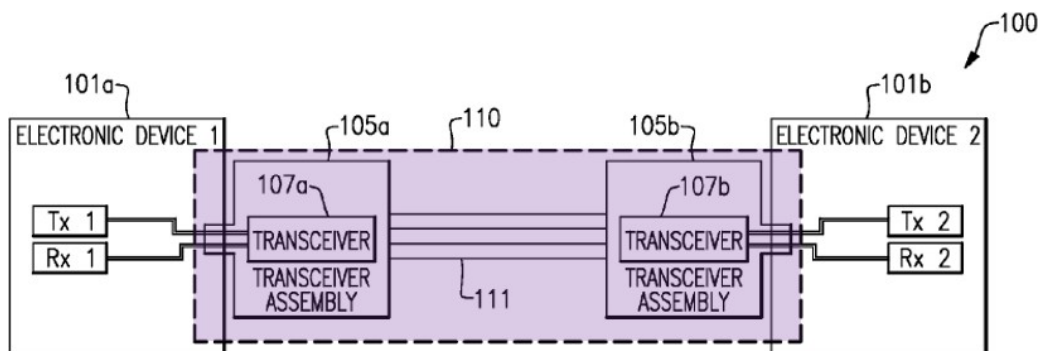


**FIG. 2A**

## 2. Limitation [1.A]

|     |                                                                                          |
|-----|------------------------------------------------------------------------------------------|
| 1.A | <i>electrical conductors connected between a first connector and a second connector,</i> |
|-----|------------------------------------------------------------------------------------------|

Lugthart-993+Aronson’s cable 110 includes “electrical conducting lines 111.” Lugthart-993, 15:48-60. Conducting lines 111 are *electrical conductors connected between* first and second transceiver assemblies 105a/105b configured to be “electrically connected” to first and second electronic devices 101a/101b, respectively. Lugthart-993, Fig. 2A (below), 14:3-16; Fayed, ¶162.

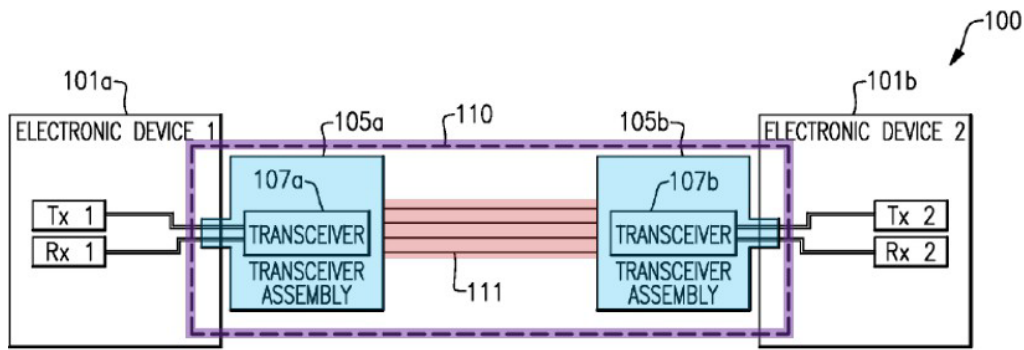


**FIG. 2A**

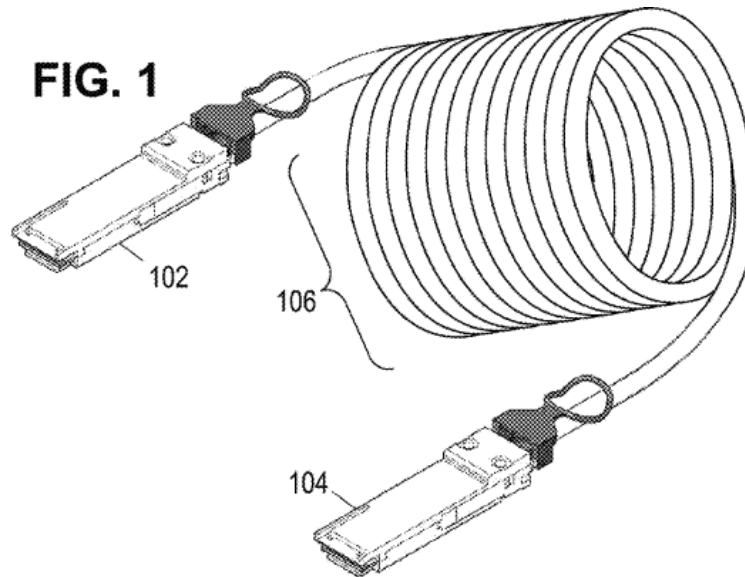
Lugthart-993 describes transceiver assemblies 105a/105b each comprising “an input port that is configured to mechanically and electrically connect... in a releasable fashion, to a corresponding port or other interface” on respective electronic devices 101a/101b, where the input ports include connectors similar to “small form-factor pluggable (SFP)” and/or “quad [SFP] (QSFP)” connectors, meeting the *first* and *second* connector, respectively. Lugthart-993, 15:8-23; Fayed, ¶¶163-164.

### 3. Limitation [1.B.i]

|       |                                                                                                                          |
|-------|--------------------------------------------------------------------------------------------------------------------------|
| 1.B.i | <i>each of the first and second connectors being adapted to fit into an Ethernet port of a corresponding host device</i> |
|-------|--------------------------------------------------------------------------------------------------------------------------|

The '252 Patent describes cable connectors with plugs “adapted to fit a standard-compliant Ethernet port” of host devices. EX1001, 4:27-34; *see also* 6:44-54 (specifications for connections are in the Ethernet standard and “within the [POSA]’s knowledge”). '252 Patent Figure 1 (below) illustrates connectors 102

and 104. The illustrated connectors are industry-standard SFP or QSFP-type Ethernet port connectors. Fayed, ¶¶165-168.



Lugthart-993+Aronson's cable 110 meets [1.B.i] because each *connector* (transceiver assembly 105a/105b) is adapted to “mechanically and electrically connect... to a corresponding *port*” on an electronic device 101a/101b, which is a *host device*. Lugthart-993, Fig. 2A (below), 15:14-19. Each host device port is an *Ethernet port of a corresponding host device* because cable 110 is configured for Ethernet communications (Lugthart-993, 15:64-16:5) and transceiver assemblies 105a/105b have connectors compliant with the same standards shown in '252 Patent Figure 1. Fayed, ¶¶169-170; Lugthart-993, 15:8-23 (*e.g.*, SFP, QSFP).

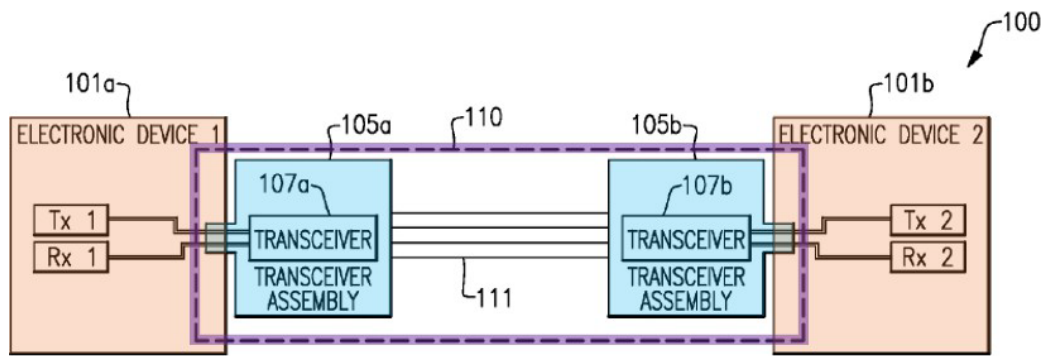


**FIG. 2A**

#### 4. Limitation [1.B.ii]

|        |                                                                                                                                                                                                                                   |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.B.ii | <i>to receive from that host device an electrical input signal conveying an inbound data stream to the cable and to provide to that host device an electrical output signal conveying an outbound data stream from the cable,</i> |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

“[I]nbound” and “outbound” streams are between hosts and the cable, named from the cable’s perspective: “inbound data streams... enter the cable” and “outbound data streams... exit the cable.” EX1001, 3:67-4:3, 4:27-32. In Lugthart-993+Aronson, cable 110’s “EGRESS/TRANSMIT” path is “inbound,” and its “INGRESS/RECEIVE” path is “outbound.” See §VI.A; Lugthart-993, Fig. 1A (below); Fayed, ¶171.

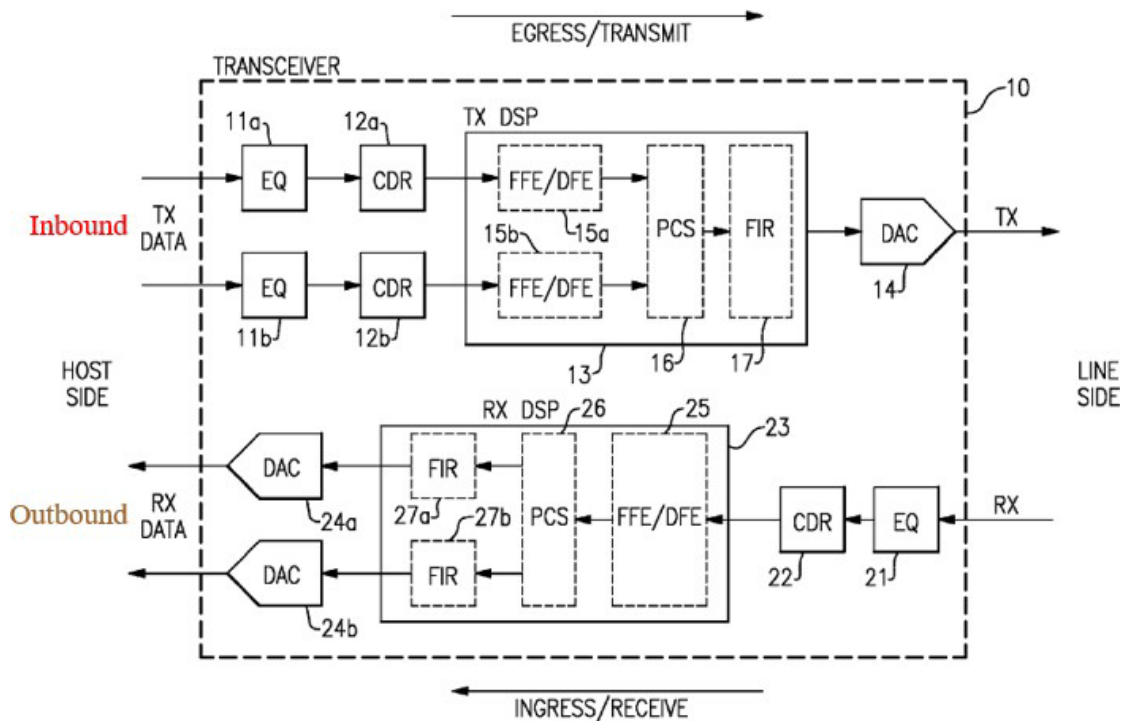


**FIG. 1A**

Lugthart-993+Aronson’s *connectors* (transceiver assemblies 105a/105b) each receives, from its respective *host device*, an electrical input signal conveying an inbound data stream to the cable (“egress/transmit” data stream) and provides, to its respective *host device*, an electrical output signal conveying an output data stream from the cable (“ingress/receive” data stream). Lugthart-993, 15:35-47, Fig. 1A, 7:6-17 (describing host-side and line-side “data streams”), 9:6-17 and 23:4-7 (transceiver components generate and/or process “data streams”), 13:33-35, 15:48-52 (data streams conveyed as electrical signals); Fayed, ¶¶172-173.

## 5. Limitation [1.C]

|     |                                                                                                                                                                                                                                                                                                                                |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.C | <i>each of the first and second connectors including a respective transceiver that performs clock and data recovery on the electrical input signal to extract and re-modulate the inbound data stream for transit via the electrical conductors as a respective electrical transit signal conveying a transit data stream,</i> |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Lugthart-993+Aronson's *connectors* (Lugthart-993's transceiver assemblies 105a/105b) each ... includes a respective transceiver (transceivers 107a/107b, respectively). Lugthart-993, Fig. 2A (below), 14:21-26, 14:64-15:1. Transceivers 107a/107b each perform *clock and data recovery on the input signal to extract and re-modulate the inbound data stream for transit via* conductive lines 111 as discussed below. Fayed, ¶174.

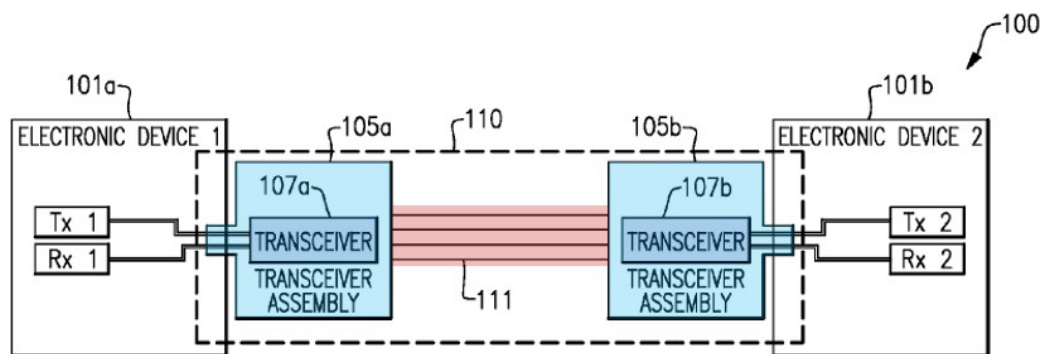


**FIG. 2A**

As shown in Figure 1A (below), each transceiver processes an *electrical input signal* conveying inbound data stream TX by equalizing the signals using equalizers 11a/11b, then performs clock and data recovery (“CDR”), via CDR

circuits 12a/12b and DSP 13's FFE/DFE 15a/15b on the equalized *electrical input signal* to extract the inbound data stream. Lugthart-993, 9:6-18, 1:57-2:23, 7:49-8:5, also 34:29-35:32 (“CDR system” of equalizer, CDR, and FFE/DFE); Fayed, ¶¶121-122, 175.

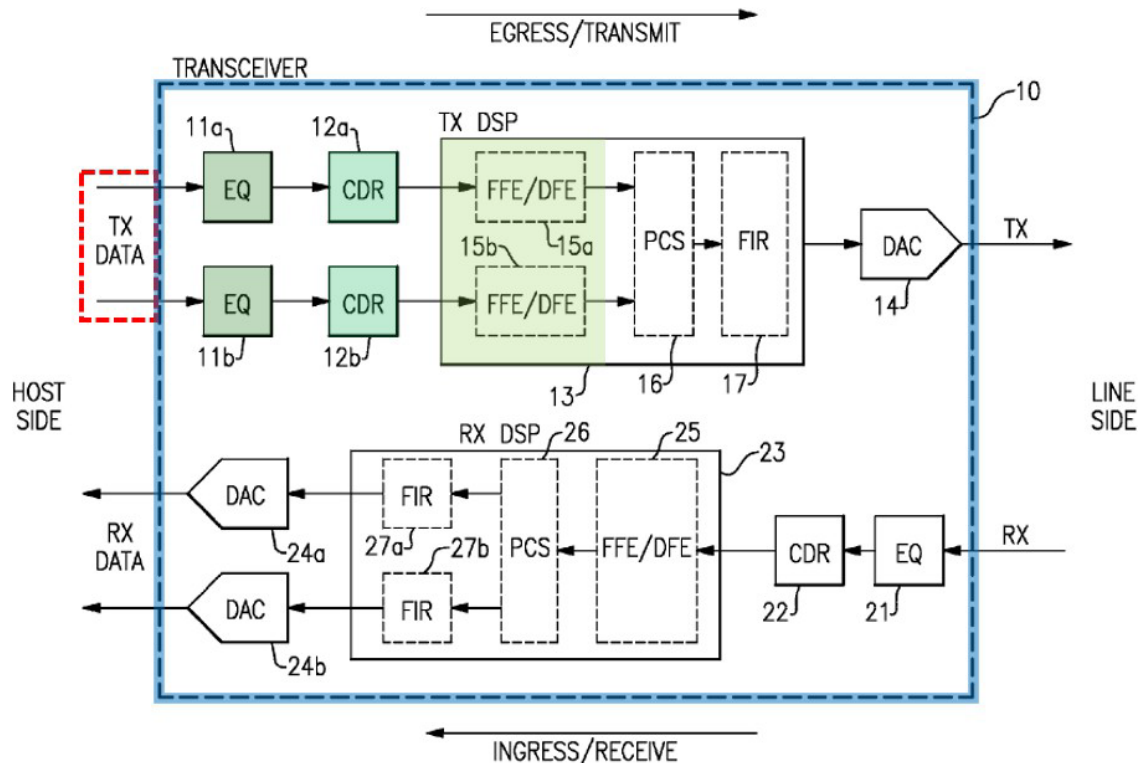


**FIG.1A**

Shown in Figure 1A (below), the extracted and recovered data is processed by PCS 16 and FIR 17 to “generate a serialized or multiplexed output signal having a desired *modulation* format” and to perform output pre-emphasis for the output signal, respectively, which DAC 14 converts into an analog signal for transmission as line-side signal TX. Lugthart-993, 4:11-19, 7:67-8:2, 9:19-51; see also 8:32-41 (transceivers 107a/107b communicate NRZ-modulated host-side

signals and PAM-4 modulated line-side signals), 9:41-46, 12:56-13:28, 23:13-19, and 52:52-53:67 (listing modulation formats/conversions), 9:52-10:3 (DACs convert digital-to-analog); 23:20-30, 28:42-47, and 30:24-39 (FIR filters used for output pre-emphasis); Fayed, ¶¶123, 176. Therefore, each transceiver further *re-modulate[s] the extracted inbound data stream for transit via the electrical conductors as a respective electrical transit signal conveying a transit data stream.*

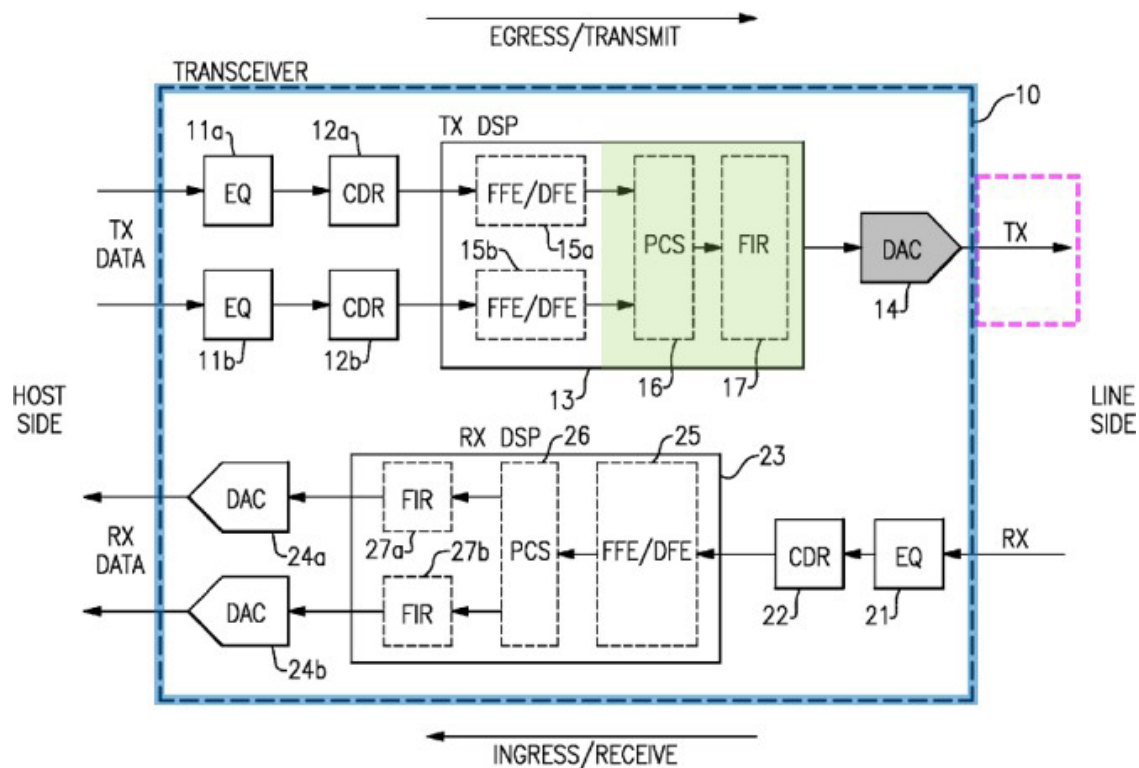


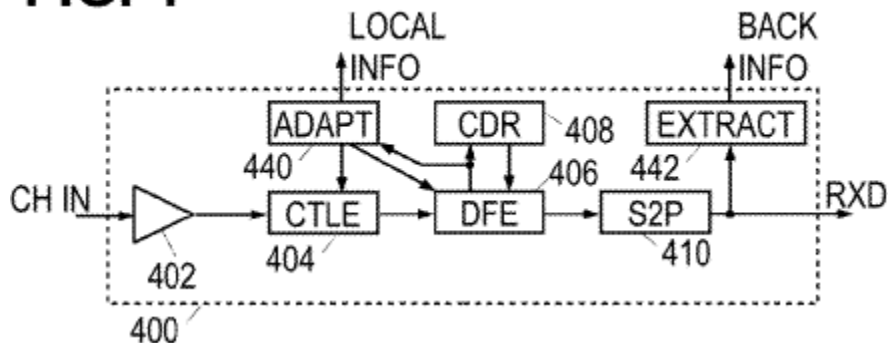
**FIG.1A**

Nothing in the '252 Patent specification precludes pre-processing the input signal conveying the inbound data stream received from the host before performing CDR (*i.e.*, processing by Lugthart-993's equalizers 11a/11b before CDR), as CDR in the '252 Patent is performed on a signal that is pre-processed in the transceiver.

EX1001, 6:62-7:16, Fig. 4 (below; CTLE 404 equalizes prior to CDR 408).

Likewise, Patent Owner (“PO”) has alleged infringement by products that perform “input equalization,” which does not appear internal to CDR functions. EX1039, 11-17 (limitations [1.C]-[1.D], identifying clock and data recovery via “retiming”), 17-25 (limitation [1.E], identifying parameters for “input equalization” and “output equalization”). Fayed, ¶¶177-179.

**FIG. 4**



## 6. Limitation [1.D]

|     |                                                                                                                                                                                                                                                                 |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.D | <i>the respective transceiver for each of the first and second connectors performing clock and data recovery on the respective electrical transit signal to extract and re-modulate the transit data stream as the outbound data stream from the cable, and</i> |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

As shown in Lugthart-993 Figure 1A below, in generating outbound data stream RX DATA, *the respective transceiver* (transceiver 107a/107b) *for each of the first and second connectors* (transceiver assemblies 105a/105b) *perform[s] clock and data recovery on the respective electrical transit signal* (line-side received signal RX) by equalizing the signal using equalizer 21, and performing

CDR, via CDR circuit 22 and FFE/DFE 25, on the equalized *electrical transit signal to extract the transit data stream*. Lugthart-993, 1:57-2:23, 9:6-18; also 34:29-35:32 (“CDR system” of equalizer, CDR, and FFE/DFE); §VI.D.5 *supra*; Lugthart-993, 8:58-9:17, 22:48-50, 23:31-37 (similar components/functions in egress and ingress paths); Fayed, ¶¶91-105, 121-122, 181.

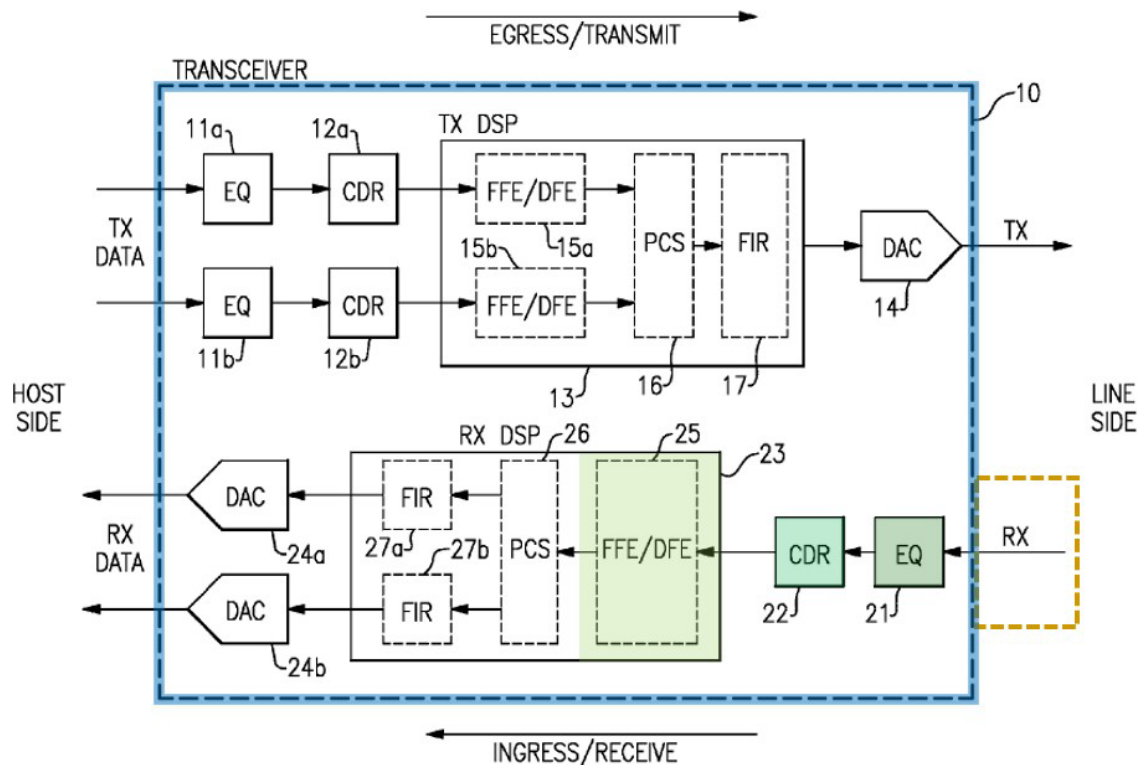


**FIG.1A**

Transceiver assemblies 105a/105b then *re-modulate the transit data stream* via PCS 26 and FIRs 27a/27b to “deserialize the data to generate output signals having a desired **modulation** format for host side transmission” and to perform output pre-emphasis for the output signal, respectively, which DACs 24a/24b then convert into analog signals for transmission *as the outbound data stream from the*

*cable* RX DATA. Lugthart-993, 7:49-57, 7:63-8:14, 9:19-22, 9:46-10:3, 22:31-40 (outputting NRZ or “any other suitable *modulation* format”); §VI.D.5 ([1.C]) *supra* and Lugthart-993, 8:58-9:17, 22:48-50, 23:31-37 (similar components/functions in egress and ingress paths); Fayed, ¶¶123, 182-183.

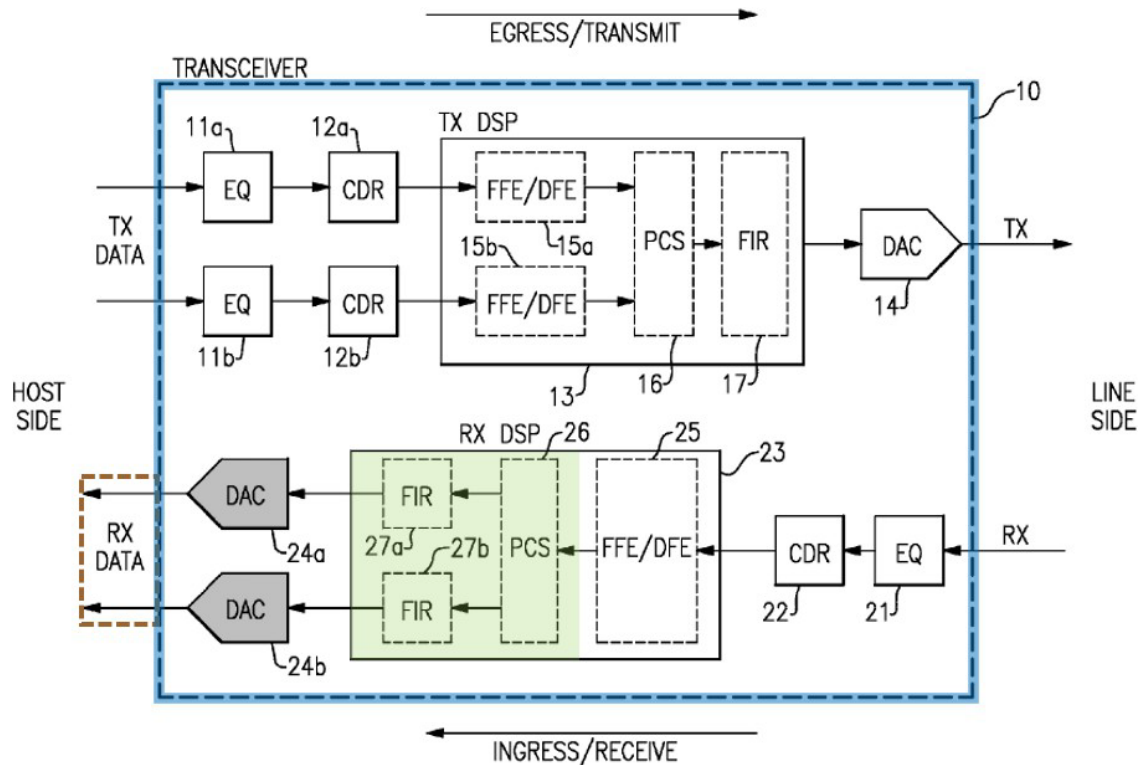


**FIG.1A**

## 7. Limitation [1.E]

|     |                                                                                                                                                                                                                                                                     |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.E | <i>the respective transceivers each employing fixed, cable-independent, equalization parameters for each of: the remodulation of the transit data stream as the outbound data stream, and the clock and data recovery performed on the electrical input signal.</i> |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Limitation [1.E] recites using “*fixed cable-independent equalization parameters*” for the equalizing the *input signal* from the host and pre-equalizing the

*outbound data stream* to the host. Lugthart-993+Aronson's *transceivers* (107a/107b) each performs equalization *for the remodulation of the transit data stream as the outbound data stream* (by FIRs 27a/27b coupled to DACs 24a/24b) and *for the [CDR] performed on the electrical input signal* (by equalizers 11a/11b), both using *fixed cable-independent parameters* as detailed below. Fayed, ¶184.

***a. electrical input signal***

Lugthart-993's equalizers 11a/11b equalize the *electrical input signal* conveying inbound data stream TX DATA and CDR circuits 12a/12b and FFE/DFE 15a/15b perform *clock and data recovery* on the equalized input signal §VI.D.5 ([1.C]) *supra*; Lugthart-993, Fig. 1A (below).

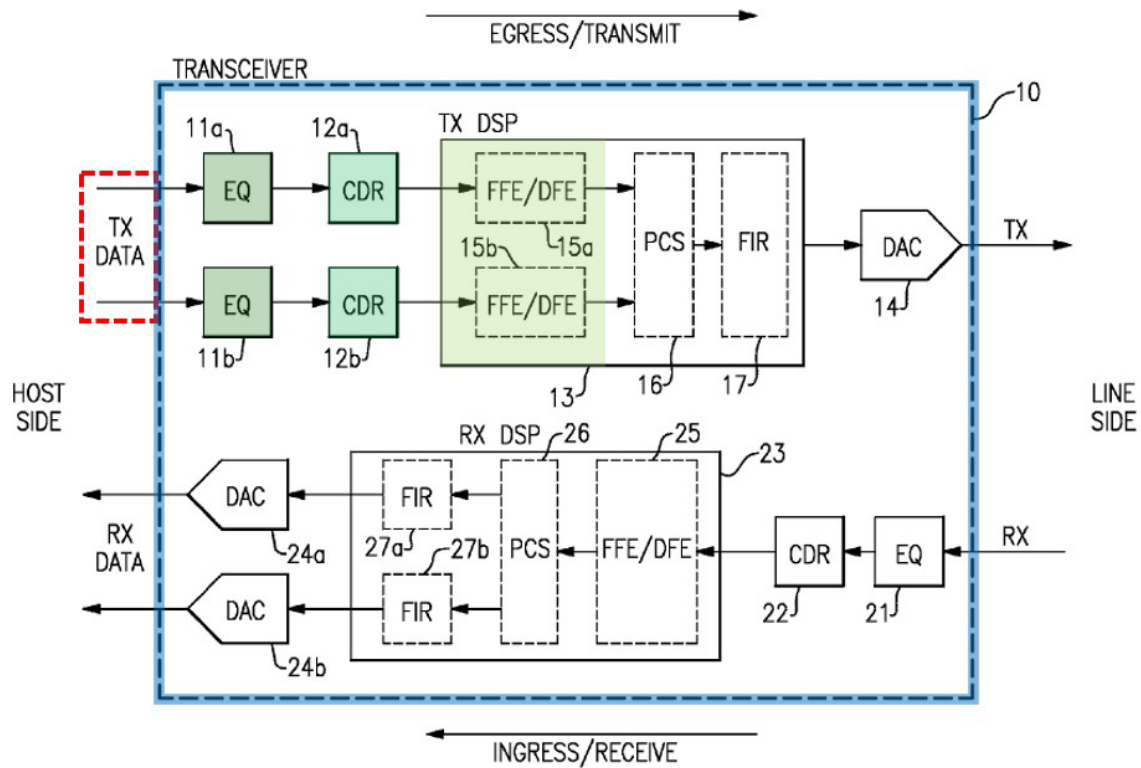


**FIG.1A**

Equalizers 11a/11b “compensate for transmission line losses on the *host* side;” therefore, POSAs understood that they use at least some *parameters* that are *cable-independent equalization parameters*. Lugthart-993, 8:58-9:5; §VI.C.1 *supra*; Fayed, ¶¶185-186.

As explained in §VI.D.5 ([1.C]) *supra*, the ’252 Patent performs equalization before performing CDR, and thus [1.E]’s requirement that the transceiver employ equalization parameters “*for... the [CDR]*” is properly construed to cover equalization by an equalizer before a CDR circuit performs CDR on the equalized signal, as disclosed by Lugthart-993. Fayed, ¶187; EX1039, 11-25 (discussed §VI.D.5 *supra*).

### b. outbound data stream

Lugthart-993's FIRs 27a/27b provide output pre-emphasis in the remodulation of the transit data stream as the outbound data stream performed by PCS 26 and FIRs 27a/27b and DACs 24a/24b §VI.D.6 ([1.D]) *supra*; Lugthart-993, Fig. 1A (below).

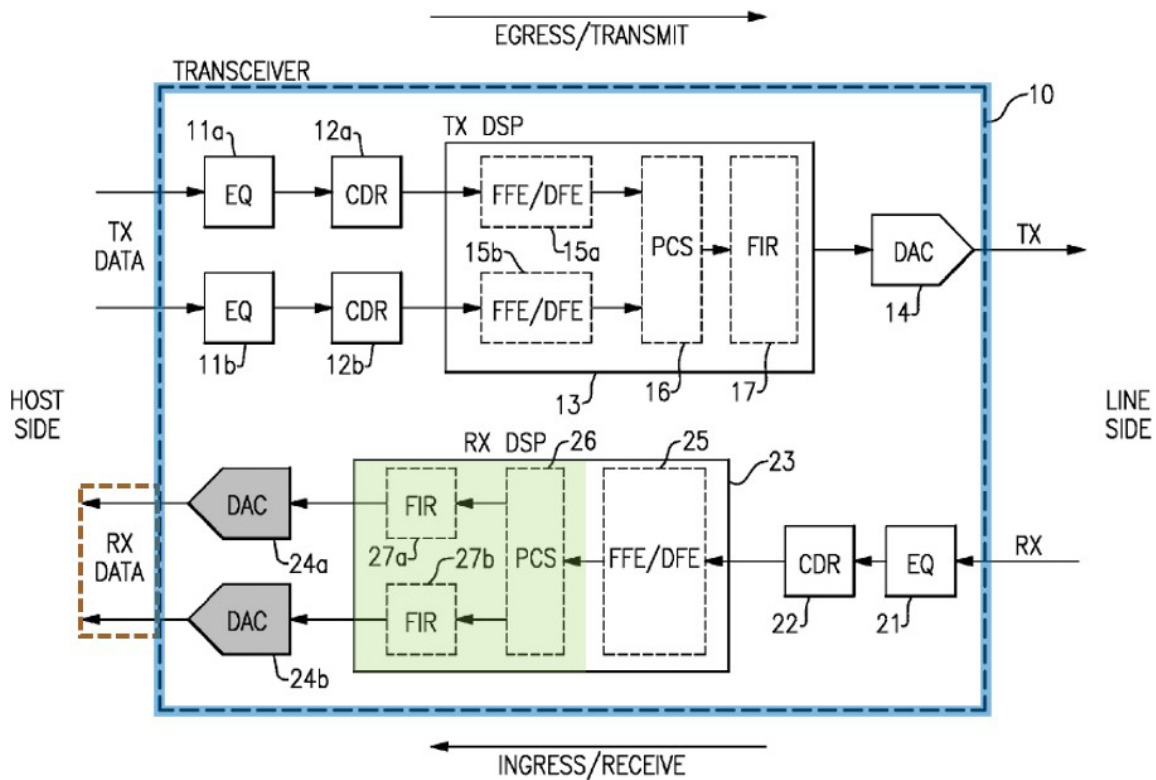


**FIG.1A**

FIRs 27a/27b's output pre-emphasis uses *cable-independent equalization parameters* for the *remodulation*. Specifically, FIRs 27a/27b condition the data signal by outputting time-varying levels that, when converted to analog by DACs 24a/24b, yield a remodulated signal equalized to suffer less distortion/degradation when transmitted. Lugthart-993, 30:24-39 (the FIR filters

condition signals for output), 23:23-25 (“FIR filters... perform emphasis on the signal to compensate for channel losses”), 21:33-46 (FIR filter tap coefficients are *equalization* parameters), 22:41-50 (DSP 13 and DSP 23 components are functionally similar), 28:42-47 (transceivers perform “output pre-emphasis”); Fayed, ¶¶188-190 (pre-emphasis means pre-equalization).

FIRs 27a/27b prepare the outbound data stream for transmission to the host and operate on a data stream already equalized (by equalizer 21) for *line-side* losses. Lugthart-993, 8:58-60; *infra* §VI.E (claim 2). Thus, POSAs understood that FIRs 27a/27b employ “*cable-independent*” equalization parameters to pre-equalize the signal for *host-side* losses. *Supra* §VI.C.1; Fayed, ¶190; EX1001, 5:2-5 (“*equalization parameters*” include parameters for transmitter-side pre-equalizers).

The FIRs 27a/27b and associated DACs 24a/24b meet the claim language. They collectively perform the same functions as transmit filter 506 of the ’252 Patent. EX1001, 7:53-56. Even if “re-modulation” were clearly linked to transmit filter 506, which it is not, nothing in the ’252 Patent specification supports interpreting [1.E] to require that equalization and remodulation be performed by a single functional block in Lugthart-993’s transceiver. *Cross Med. Prods. Inc. v. Medtronic Sofamor Danek, Inc.*, 424 F.3d 1293, 1309 (Fed. Cir. 2005) (“mere depiction of a structural claim feature as unitary in an embodiment, without more, does not mandate that the structural limitation be unitary.”). To the contrary,

limitation [1.E] uses the same “*employing... equalization parameters for*” language in connection with “*each of*” remodulation as the outbound stream to the host and CDR on the input signal from the host, and the specification is explicit that equalization can be performed by a different functional block than the one that does the CDR. *Supra* §VI.D.7.a; *see also* EX1039, 11-25 (discussed §VI.D.5 *supra*). Fayed, ¶191.

Thus, [1.E]’s requirement that the transceiver employ equalization parameters “*for... remodulation... as the outbound data stream*” is properly construed to cover conditioning the signal for transmission via pre-equalization and then converting it to analog form as an outbound data stream to the host, as disclosed in Lugthart-993. Fayed, ¶191.

***c. fixed, cable-independent***

To the extent Lugthart-993 does not explicitly describe its equalizers 11a/11b and FIRs 27a/27b as utilizing “*cable-independent*” parameters, as confirmed by Aronson and other references corroborating a POSA’s background knowledge, that would have been the conventional and obvious way to implement what Lugthart-993 describes. *Supra* §VI.C. Additionally, as the same corroborating references and Aronson teach, it would have been obvious to use “*fixed cable-independent*” parameters for Lugthart-993’s equalizers 11a/11b and FIRs 27a/27b. *Supra* §VI.C.1. Thus, Lugthart-993+Aronson’s pre-equalization of

the output data stream to the host, and its equalization of the input stream's electrical signal from the host, both use *fixed cable-independent equalization parameters*. Fayed, ¶¶192-194.

#### **E. Claim 2**

Dependent claim 2 recites the transceivers as each employing “*cable-dependent equalization parameters for at least one of: the remodulation of the inbound data stream for transit [to the line-side], and the [CDR] performed on the electrical transit signal*” from the line-side. Meeting claim 2 only requires meeting “at least one” of those uses. Fayed, ¶195. Lugthart-993+Aronson meets claim 2 in two alternative ways because it meets both uses.

##### **1. Remodulation of Inbound Data Stream for Transit**

Lugthart-993+Aronson's *transceivers* (107a/107b), via PCS 16, FIR 17, and DAC 14, each remodulates the inbound data stream for transit over the cable as a line-side signal TX. *Supra* §VI.D.5 ([1.C]). FIR 17 performs part of the remodulation by shaping signals for better transmission through the cable's conductors, with DAC 14 converting the shaped signal to an analog signal. Lugthart-993, 23:4-30, 30:24-39, Fig. 1A. Fayed, ¶196.

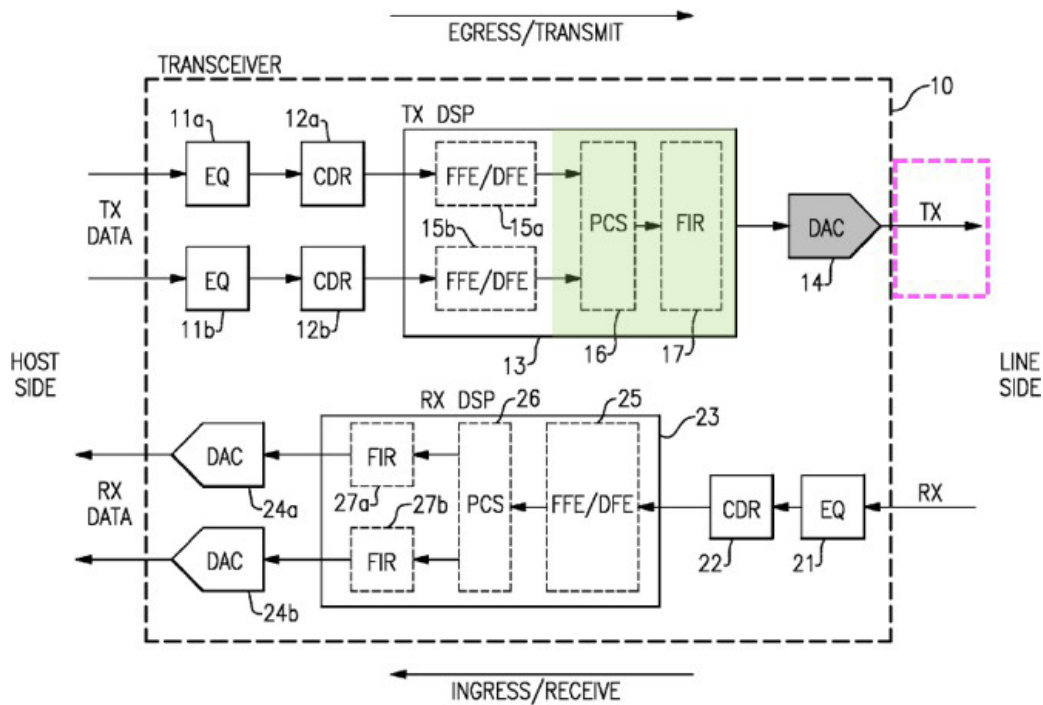


**FIG.1A**

FIR 17 employs equalization parameters for “perform[ing] emphasis on the signal to compensate for channel losses.” *Id.* POSAs understood that this describes pre-equalization for “channel” losses through the cable’s conductors (line-side) because equalizers 11a/11b already compensated for host-side losses for CDR and because Lugthart-993’s transceivers perform pre-equalization. Lugthart-993, 9:19-32 (DSPs process data already recovered by CDR circuits), 28:42-47 (output pre- emphasis), 29:59-30:5, 30:24-39 (the FIR filters condition signals for output); Fayed, ¶197. Because its equalization compensates for transmission losses over the cable, POSAs understood that FIR 17 employs equalization parameters that are “cable-dependent.” *Supra* §VI.C.2; Fayed, ¶197.

To the extent Lugthart-993 is considered to not explicitly describe FIR 17's equalization as using “cable-dependent” parameters, that would have been the conventional and obvious way to implement Lugthart-993's described equalization to address losses over the cable, as confirmed by Aronson and numerous other references corroborating a POSA's background knowledge. *Supra* §VI.C.2; Fayed, ¶198; Aronson, Fig. 12A (below), 14:33-43 (pre-emphasis/output driver performs pre-equalization to overcome “loss on the cable” using *cable-dependent* parameters that “match the particular length [and/or] the characteristics of the copper cabling”).

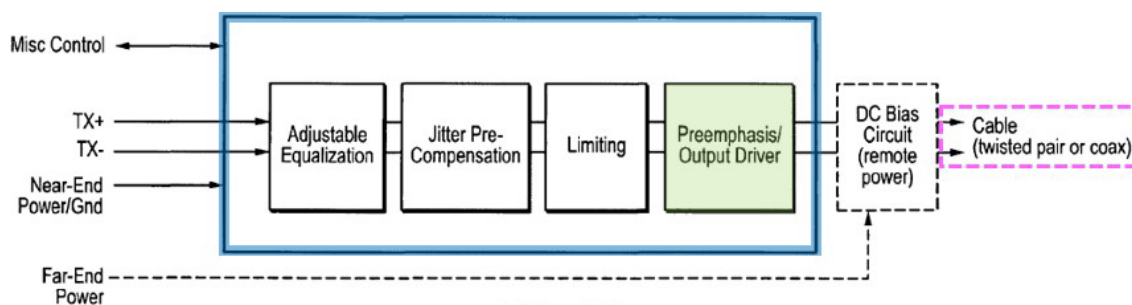


FIG. 12A

Performing equalization and conversion to analog in separate functional blocks meets the proper construction of employing “equalization parameters for the remodulation” of a data stream for the same reasons discussed *supra* §VI.D.7 ([1.E]); Fayed, ¶199.

Thus, Lugthart-993+Aronson meets claim 2's alternative (“at least one”) of *employing cable-dependent equalization parameters for the remodulation of the inbound data stream for transmit*. Fayed, ¶200.

## 2. CDR on the Received Transit (Line-Side) Signal

CDR circuit 22 and FFE/DFE 25 in Lugthart-993+Aronson's *transceiver* (107a/107b) performs CDR on the equalized received line-side transit data stream. *Supra* §VI.D.6 ([1.D]); Fayed, ¶201. Equalizer 21 "compensate[s] for transmission line losses on the line side" and thus uses *cable-dependent equalization parameters*. Lugthart-993, 8:58-9:5; *see also id.*, 22:4-9 (compensates for losses "over the cable"), Fig. 1A; Fayed, ¶201.

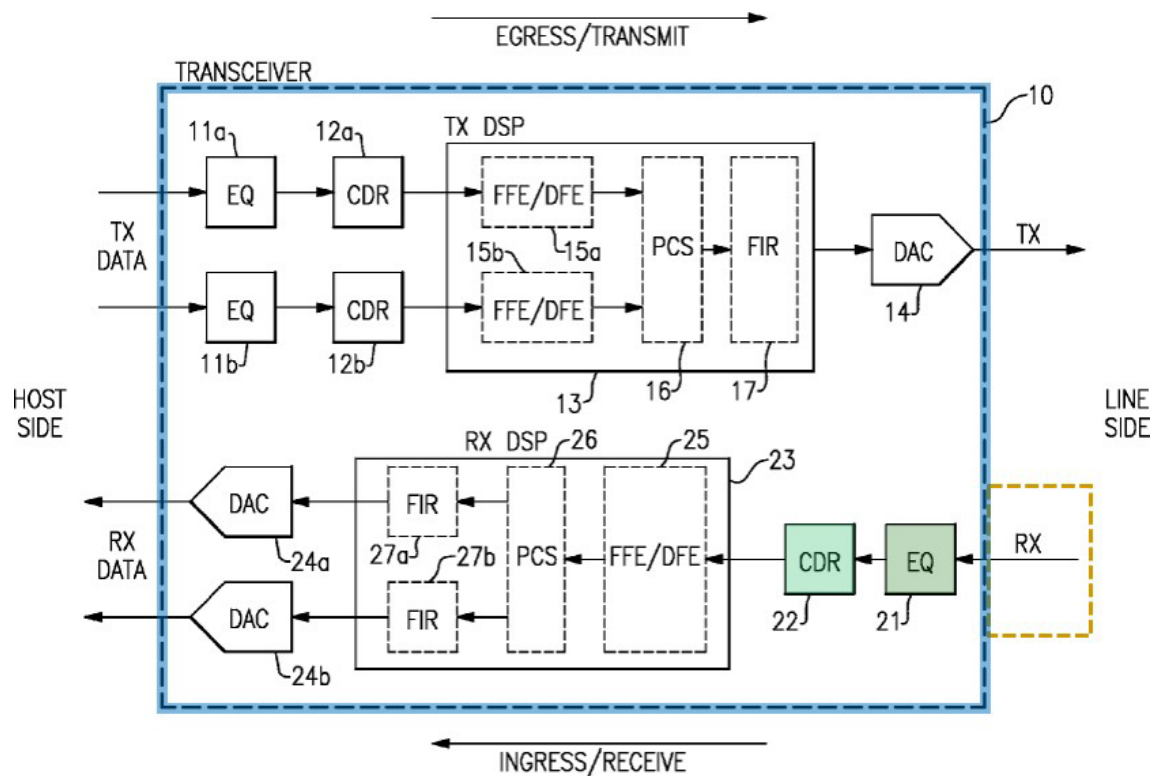


**FIG.1A**

To the extent that Lugthart-993 is considered to not explicitly describe equalizer 21 as using "cable-dependent" parameters, that would have been a conventional and obvious way to implement what Lugthart-993 describes as

confirmed by Aronson and other references corroborating a POSA’s background knowledge. *Supra* §VI.C.2; Fayed, ¶202; Aronson, Fig. 12B (below), 15:1-8 equalization “compensate[s] for the cable” losses using *cable-dependent parameters* based on “cable length and characteristics”).

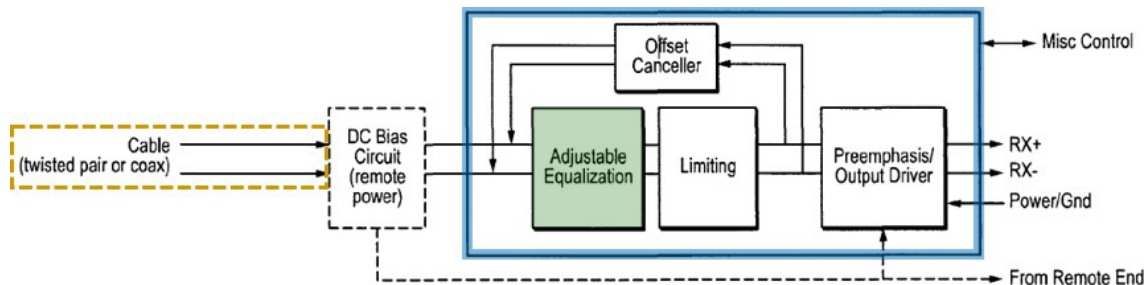


**FIG. 12B**

Performing equalization and CDR in separate functional blocks meets the proper construction of employing “equalization parameters for [CDR]” for the same reasons discussed *supra* §VI.D.7 ([1.E]). Fayed, ¶203.

Thus, using cable-dependent parameters in Lugthart-993’s equalizer 21 meets claim 2’s alternative (“at least one”) of *employing cable-dependent equalization parameters for the [CDR] performed on the electrical transit signal*. Fayed, ¶204.

### F. Claim 3

|   |                                                                                                                                             |
|---|---------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | <i>The active Ethernet cable of claim 2, wherein said cable-dependent equalization parameters adapt during usage of the Ethernet cable.</i> |
|---|---------------------------------------------------------------------------------------------------------------------------------------------|

The ’252 Patent describes three “usage” phases: (1) the cable is tested during a manufacturing-testing phase (8:16-38); (2) after cable installation in the field a

training phase is performed during which equalization parameters can be adapted from factory-set values (7:27-47, 8:31-37); and (3) “normal operations” begin after the training phase (7:46-50). While claim 4 refers to “normal usage,” claim 3 more broadly recites “during usage” which encompasses adaptation during use of the cable in a training phase. Fayed, ¶205.

Lugthart-993 describes training phases during which “parameters of the components in the transceivers connected to the first and second electronic devices are adjusted” including “parameters for the equalizers.” Lugthart-993, 47:56-48:27. POSAs understood that the transceivers “connected to” the host electronic devices are the cable’s transceivers. Lugthart-993, 28:40-47 (cable transceivers are “adaptive” for performing equalization including pre-emphasis); Fayed, ¶206 (pre-emphasis means pre-equalization).

Claim 3’s “*said cable-dependent equalization parameters*” find their antecedent in claim 2, which requires their use in “at least one” of two alternative ways. The cable-dependent equalization performed by Lugthart-993+Aronson’s FIR 17 and equalizer 21 meets both alternatives. *Supra* §VI.E (claim 2); Lugthart-993, 8:58-60, Fig. 1A (below). To the extent Lugthart-993 is considered to not specifically teach **adapting** the equalization coefficients used by FIR 17 and equalizer 21 during Lugthart-993’s training phases, that would have been a conventional and obvious way to implement what Lugthart-993 describes—

Aronson and other references corroborating a POSA's background knowledge as discussed *supra* VI.C.2.a confirm. Fayed, ¶207.

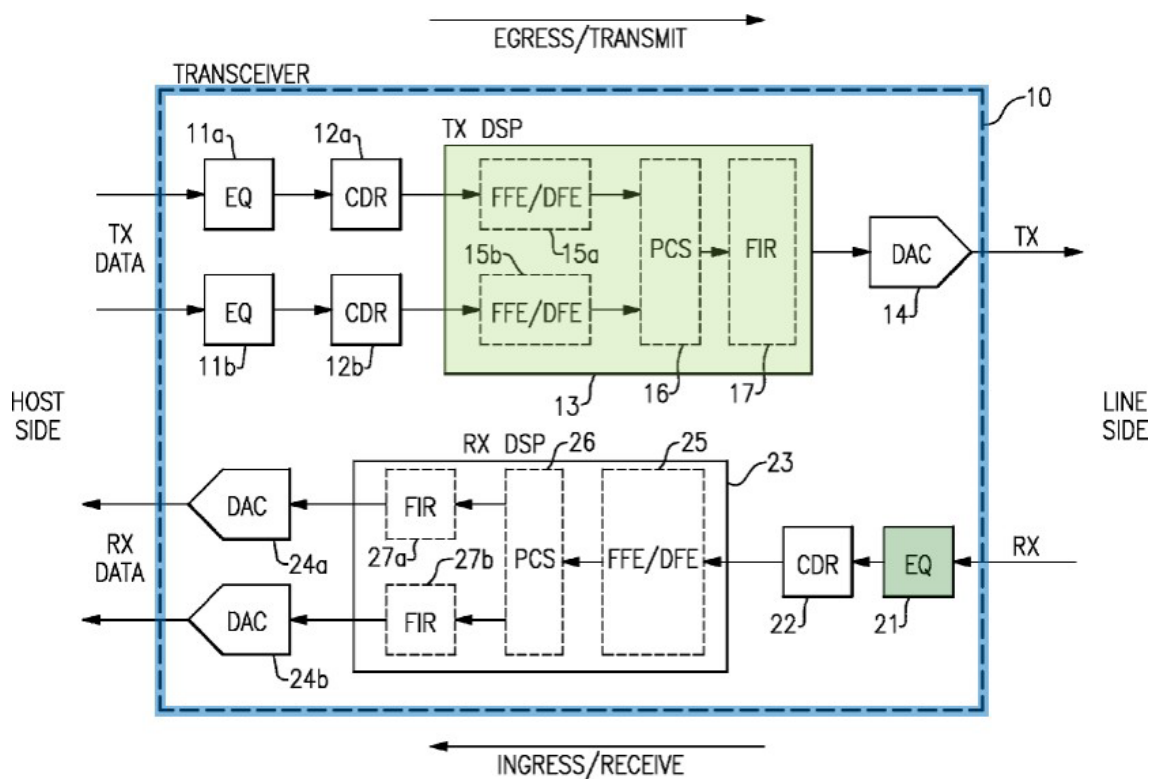


**FIG.1A**

Lugthart-993+Aronson's cable-dependent parameters (1) used by FIR 17 to perform equalization *for the remodulation of the inbound data stream for transmit* to the line side, and (2) used by equalizer 21 *for the [CDR] performed on the electrical transit signal (supra §VI.E (claim 2)), are adapted during training (supra §VI.C discussing the combination)) and thus are “adapt[ed] during use of the Ethernet cable”* because, as discussed above, claim 3's “*during usage of the Ethernet cable*” is broader than claim 4's “*normal usage*” and encompasses usage during training. Fayed, ¶¶208-209.

#### G. Claim 4

|   |                                                                                                                                                                                                                              |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4 | <i>The active Ethernet cable of claim 2, wherein said cable-dependent equalization parameters are fixed during normal usage of the Ethernet cable, and... determined during manufacturing-testing of the Ethernet cable.</i> |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Claim 4’s “*said cable-dependent equalization parameters*” find their antecedent in claim 2, which requires their use in “at least one” of two alternative ways. The cable-dependent equalization performed by Lugthart-993+Aronson’s FIR 17 and equalizer 21 meets both of claim 2’s alternatives. *Supra* §VI.E (claim 2); Lugthart-993, 8:58-60, Fig. 1A; Fayed, ¶210.

And as discussed *supra* §VI.C.2.b, one obvious way to implement Lugthart-993, based on Aronson and numerous other references confirming a POSA’s background knowledge, was to fix the equalization coefficients used by FIR 17 and equalizer 21 during manufacturing-testing. Fayed, ¶¶211-212; Aronson, 14:35-39 (Fig. 12A’s pre-equalization parameters for transit over the line-side are “adjusted at factory setup”), 15:1-8 (Fig. 12B’s equalization may be “fixed” or “adjustable but factory set” “at the time of the cable manufacture”).

Thus, Lugthart-993+Aronson meets and renders obvious claim 4.

#### H. Claim 5

|   |                                                                                                                                                        |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5 | <i>The active Ethernet cable of claim 4, wherein the inbound... and the outbound data stream each have a per-lane symbol rate in excess of 50 GBd.</i> |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------|

A “lane” is a single data communication path. EX1028 (802.3 Section 1), 86. A “symbol” is the smallest unit of data transmission over a medium and depends on the coding system used, and a “symbol rate” is a measure of symbols transferred per second, expressed in baud (“Bd”). EX1028 (802.3 Section 1), 95-96. Data streams with a “*per-lane symbol rate in excess of 50 GBd*” exceed 50 giga (billion) symbols per second, per lane. Fayed, ¶¶213-215.

Lugthart-993’s transceivers support multiple lanes for the inbound (TX) and outbound (RX) data streams. Lugthart-993, Fig. 1A; Fayed, ¶216. CDR processing by each set of equalizer (11a), CDR circuit (12a), and FFE/DFE (15a), as in Figure 1A below, has a data rate up to 300 Gbit/s. Lugthart-993, 34:39-53. POSAs understood that the other components in the same lane as these components support the same data rate because Lugthart-993’s described data rate for CDR would be meaningless if other components in the same lane only supported a lower data rate. Fayed, ¶216.

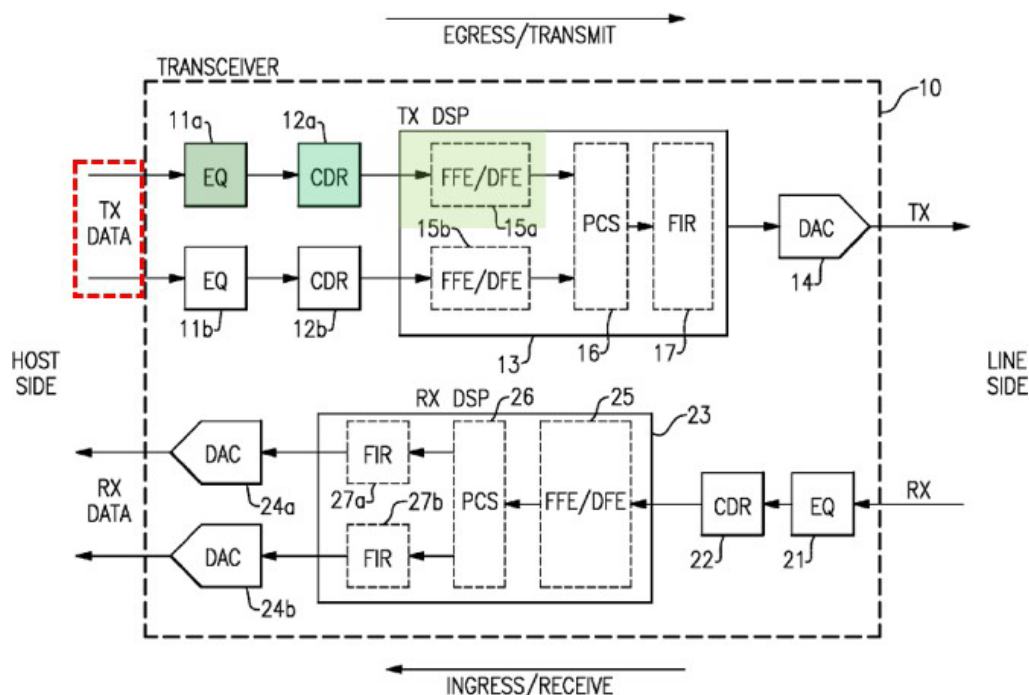


**FIG.1A**

Lugthart-993 teaches the input signal modulated in any format, for example PAM-4. Lugthart-993, 34:48-50. PAM-4 signaling operates at 4 different voltage levels, thus providing 2 bits of data per symbol. Lugthart-993, 30:54-63. At 300 Gbit/s, 2 bits/symbol PAM-4 signals communicate at 150 GBd (symbols/s), and thus Lugthart-993's CDRs 12a/12b and the rest of the components in each lane for processing the inbound data stream support per-lane symbol rates up to 150 GBd, which is *in excess of 50 GBd*. Fayed, ¶217. Given that Lugthart-993's transceiver can support the same number of lanes (*e.g.*, two each in Figure 1A) for the inbound and outbound data streams, POSAs understood that Lugthart-993 also teaches an outbound data stream with a per-lane symbol rate *in excess of 50 GBd*. Fayed, ¶¶217-218.

## I. Claim 6

Claim 6 recites a “communication method” using a “network cable” having limitations mirroring those in claim 1. Lugthart-993+Aronson meets claim 6 for the same reasons it meets claim 1. Fayed, ¶219.

### 1. Preamble

|       |                                                                                                                                                          |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.PRE | <i>A communication method that comprises, in a network cable having conductor pairs electrically connecting a first connector to a second connector:</i> |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------|

Lugthart-993+Aronson’s cable is a *network (e.g., Ethernet) cable having conductor pairs* (conducting lines 111) *that include sets of paired egress/transmit and ingress/receive conductors) electrically connecting a first connector* (transceiver assembly 105a) *to a second connector* (transceiver assembly 105b). *See supra* §§VI.D.1-VI.D.2, VI.D.4 ([1.PRE], [1.A], [1.B.ii]); Fayed, ¶220; Lugthart-993, 13:54-14:2 (link between electronic devices can connect computer and network router), 15:48-16:5, Fig. 2A (below), 16:50-54 (“a first ***paired*** differential cable for communication in a first direction and a second ***paired*** differential cable for communication in a second direction. A paired differential cable... includes a ***pair*** of wires”).

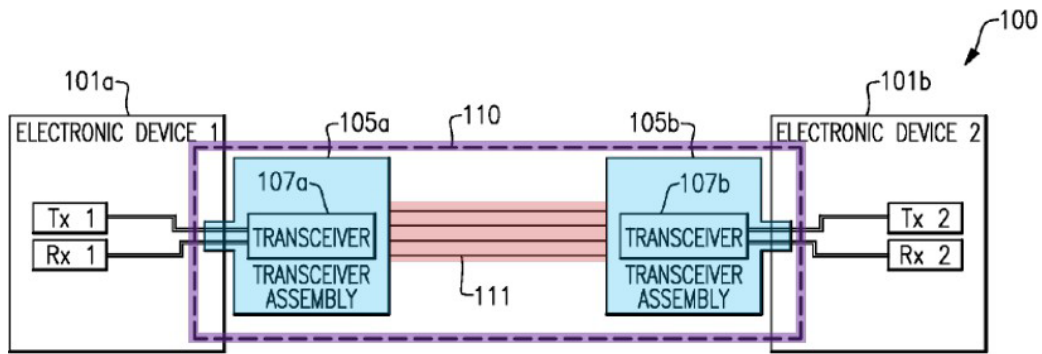


**FIG. 2A**

Lugthart-993 Figure 3A's cable has first 141 and second 142 pairs of conducting lines to, respectively, transmit signals in the egress/transmit and ingress/receive directions (Lugthart-993, 17:48-57),

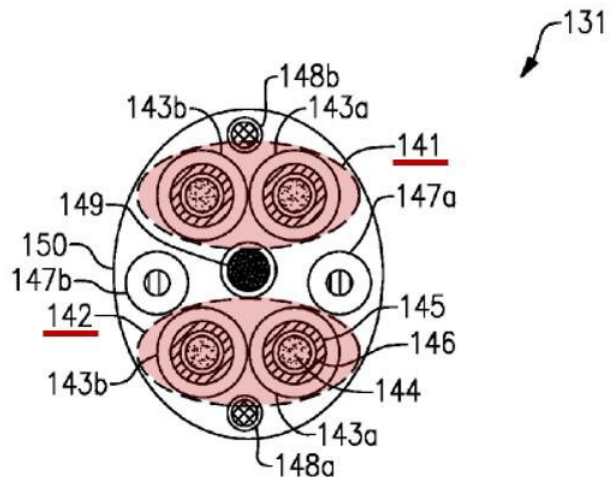
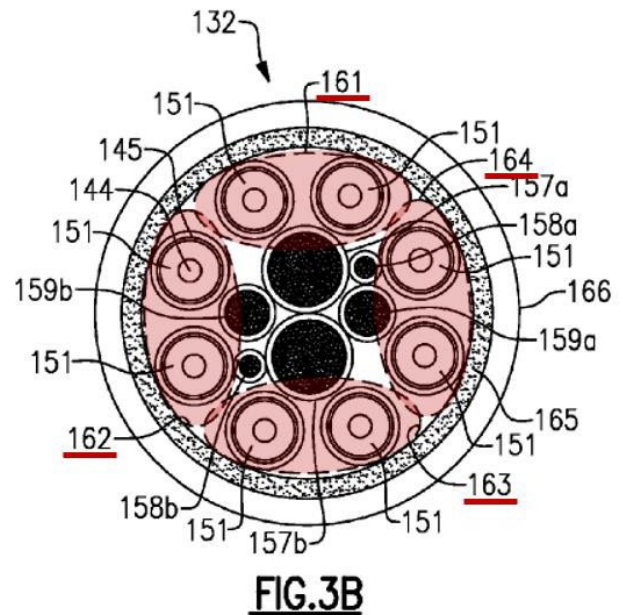


**FIG. 3A**

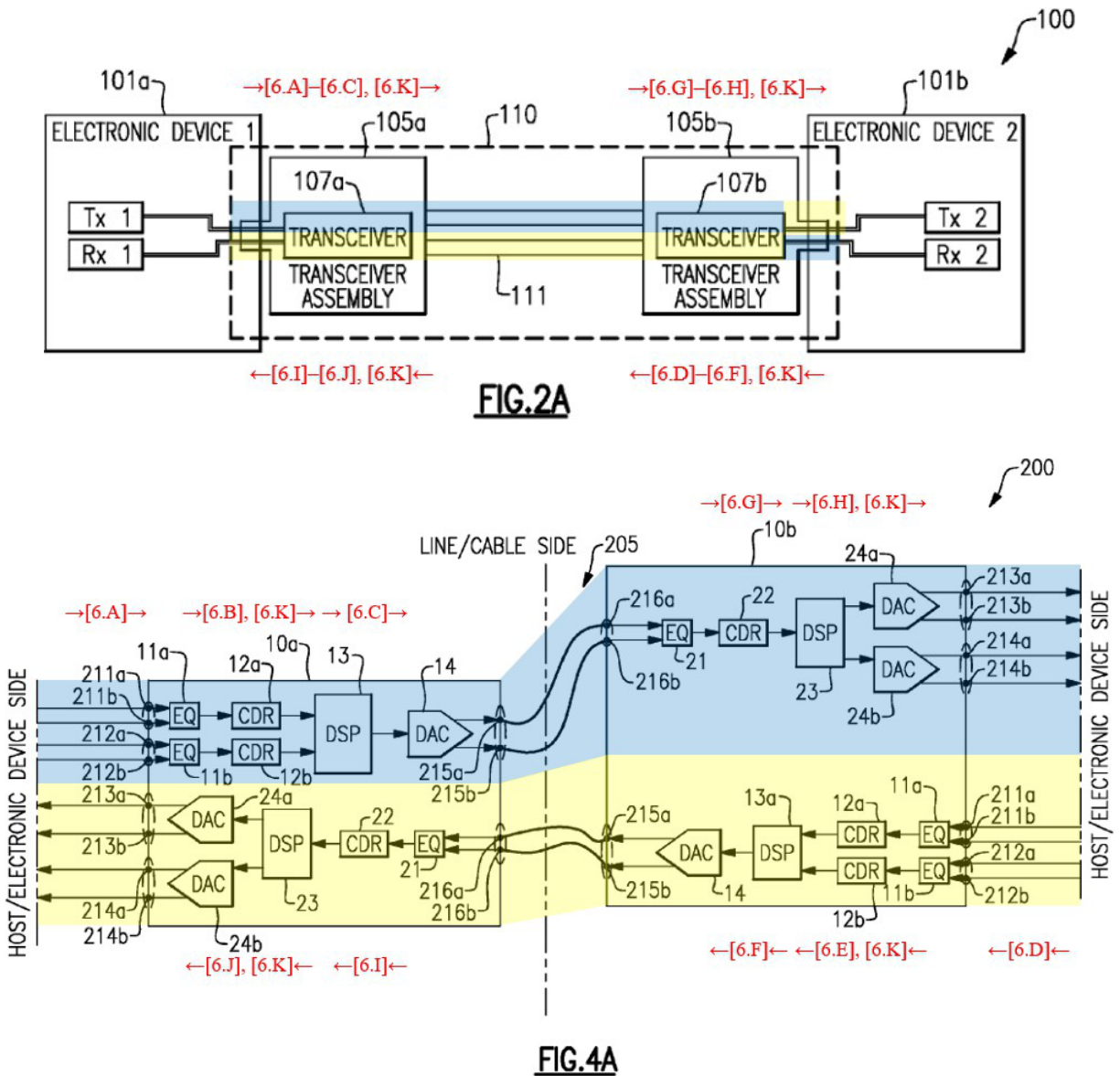
while Figure 3B's cable has **four pairs** of conducting lines 161-164 providing two logical channels in each direction (Lugthart-993, 17:63-18:9). Fayed, ¶¶221-223.



## 2. Method Steps [6.A]-[6.K]

Claim 6 recites cable-performed steps of a communication method where two data streams between first and second host devices flow in opposite directions. Fayed, ¶¶224-225.

Lugthart-993+Aronson's cable is used in a bi-directional communication method. *Supra* §§VI.C (combination), VI.D (claim 1); Fayed, ¶226. Lugthart-993 Figures 2A and 4A (below) show the two data streams (one **blue** and one **yellow**) and their corresponding steps in claim 6. Lugthart-993, 19:1-11 (Figure 4A uses Figure 1A transceivers); Fayed, ¶226.



The blue stream is a *first inbound data stream* from a first host device [left side of Figures 2A/4A] that is received by the *first connector* ([6.A]), passed through cable conductors, and conveyed as a *second outbound data stream* to the *second host device* [6.B]-[6.C], [6.G]-[6.H], [6.K]). The yellow stream is a *second inbound data stream* from the second host device [right side of Figures 2A/4A] that is received by the *second connector* ([6.D]), passed through cable conductors, and

conveyed as a *first outbound data stream to the first host device* ([6.E]-[6.F], [6.I]-[6.J]). Fayed, ¶¶227-228.

Steps [6.A]-[6.C] recite the first connector's transceiver *performing CDR* and *re-modulating* the first inbound stream for transmission over the first conductor pair, and [6.D]-[6.F] recite the same steps performed by the second connector's transceiver on the second inbound stream for transmission over the second conductor pair. Lugthart-993+Aronson meets these steps for the reasons discussed *supra* §VI.D.5 ([1.C]). Fayed, ¶229.

Steps [6.G]-[6.H] recite the second connector's transceiver *performing CDR* and *re-modulating* the (blue) data stream received over the first conductor pair, and [6.I]-[6.J] recite the same steps performed by the first connector's transceiver on the (yellow) data stream received over the second conductor pair. Lugthart-993+Aronson meets these steps for the reasons discussed *supra* §VI.D.6([1.D]). Fayed, ¶230.

Step [6.K] requires that each of the remodulating and CDR in steps [6.B]-[6.C] and [6.E]-[6.J] employ *fixed, cable-independent, equalization parameters* and is met for the reasons discussed *supra* §VI.D.7 ([1.E]). Fayed, ¶¶231-232.

**J. Claim 7**

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7 | <i>The communication method of claim 6, wherein cable-dependent equalization parameters are employed for at least one of: re-modulating the first inbound data stream, re-modulating the second inbound data stream, said performing [sic] clock and data recovery on the first electrical transit signal, and said performing clock and data recovery on the second electrical input signal, each employ fixed, cable-independent, equalization parameters.</i> |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

The above-highlighted language resulted from a publication error: it was never in application-claim 11, which issued as claim 7. EX1002, 213 (application-claim 11 in Applicant’s last response was “Original”), 232 (Allowance without Examiner’s Amendment). The language is not grammatical, nonsensical, and unsupported in the specification, which never discloses using both “cable-dependent” (examined language) and “cable-independent” equalization parameters (unexamined language).

Claim 7 should be construed to not include the above-highlighted language which was never part of the examined claim. *K/S HIMPP v. III Holdings 4, LLC*, IPR2017-00782, Paper 8, 24-25 (Jul. 27, 2017), citing *Novo Indus. L.P. v. Micro Molds Corp.*, 350 F.3d 1348, 1357 (Fed. Cir. 2003) (“A patent claim may be interpreted as if it had been corrected only if (1) the correction is not subject to reasonable debate based on consideration of the claim language and the specification and (2) the prosecution history does not suggest a different interpretation.”) (cleaned up); *Google Inc. v. Spring Ventures, Ltd.*, IPR2017-

01653, Paper 68 at 37 n.7 (Jan. 15, 2019) (nonsensical claim language interpreted with undisputed meaning reasonable to POSA); *Apple Inc. v. FastVDO LLC*, IPR2016-01203, Paper 39, 9-10 (Dec. 11, 2017) (correcting typographical error in claim dependency, *citing Hoffer v. Microsoft Corp.*, 405 F.3d 1326, 1331 (Fed. Cir. 2005)).

Properly-construed claim 7 introduces limitations substantively identical to claim 2 and Lugthart-993+Aronson meets claim 7 for the same reasons. *Supra* §VI.E; Fayed, ¶233.

#### **K. Claims 8-10**

Claims 8-10 recite limitations substantively identical to claims 3-5, respectively, and are met by Lugthart-993+Aronson for the same reasons. *Supra* §§VI.F-VI.H; Fayed, ¶¶234-236.

#### **L. Claims 11-14**

Independent claim 11 and dependent claims 12-14 recite a “cable manufacturing method” for making a cable as recited in the preceding claims. Fayed, ¶¶237-238.

##### **1. Claim 11**

Limitation [11.A] recites connecting first and second ends of conductor pairs to first and second transceivers to transmit signals therebetween. This is met by Lugthart-993+Aronson’s pairs of conductors, connected between transceiver assemblies 105a/105b and their transceivers 107a/107b, that transmit signals

between the transceivers as discussed *supra* §§VI.D.1-VI.D.5 ([1.PRE]-[1.C]), VI.I.1 ([6.PRE]), VI.I.2 ([6.C], [6.F]-[6.G], [6.I]). Fayed, ¶239.

POSAs understood that manufacturing the Lugthart-993+Aronson cable involves “*connecting*” the conductors to the transceivers so the transceivers can transmit and receive signals over the conductors. Fayed, ¶240; EX1010, Figs. 4A-4B, 6A-7, [0065], [0073]-[0075] (cable assembly involves connecting transceivers and cable conductors via contact/solder pads); EX1012, [0050], [0057], and Figs. 1-3 and 7. Alternatively, that would have been the conventional and obvious way to manufacture the Lugthart-993+Aronson cable with a reasonable expectation of success. Fayed, ¶¶240-241.

Limitations [11.B]-[11.C] are met because Lugthart-993+Aronson’s transceiver assemblies 105a/105b are first and second connectors into which first and second transceivers 107a/107b are packaged, and assemblies 105a/105b are configured to couple to input/output signals from/to network interface ports of first and second host devices, respectively. *Supra* §§VI.D.3-VI.D.5 ([1.B.i]-[1.C]); Fayed, ¶¶242-243; Lugthart-993, 14:64-15:23 (assemblies 105a/105b) “include” transceivers 107a/107b and use “enclosed” packaging conforming to interface standards such as SFP+); EX1027, 7-10 (SFP+ housing “contains” transceiver), EX1012, [0050]-[0051], Figs. 1-3.

Limitation [11.D] recites that the first and second transceivers are configured to:

- perform CDR to extract and remodulate their respective inbound data stream as signals conveyed across the conductors, which Lugthart- 993+Aronson meets for the reasons discussed *supra* §VI.D.5 ([1.C]);
- perform CDR on the signals received over the conductors to remodulate the data streams as their respective outbound data streams, which Lugthart-993+Aronson meets for the reasons discussed *supra* §VI.D.6 ([1.D]); and
- employ fixed, cable-independent, equalization parameters for the CDR operations discussed in (1) and (2), which Lugthart-993+Aronson meets for the reasons discussed *supra* §VI.D.7 ([1.E]). Fayed, ¶¶245-246.

## **2. Claims 12-14**

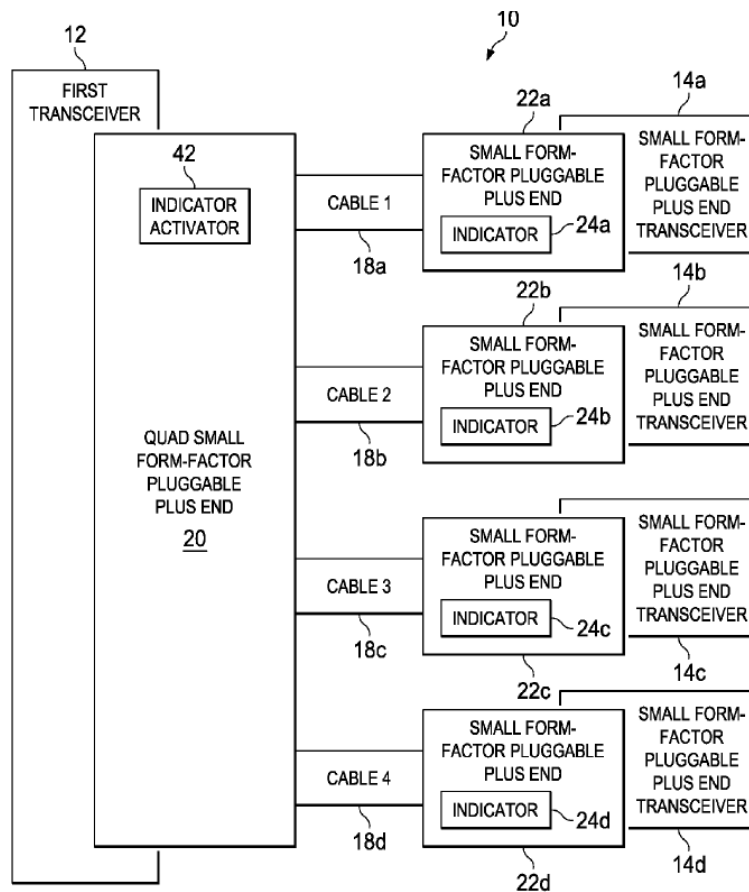
Claims 12-14 are met by Lugthart-993+Aronson for the same reasons as claims 2-4, respectively. *Supra* §§VI.E-VI.G; Fayed, ¶¶247-249 (“operation” in claim 13 means the same as “usage” in claim 3).

## VII. GROUND 2: TANG+TI-RETIMER+ARONSON RENDERS OBVIOUS CLAIMS 1-4, 6-9, AND 11-14

### A. Tang

Tang is directed to networking data cables supporting Ethernet communications between transceivers in host devices (*e.g.*, servers, routers, switches). Tang, [0001]-[0002], [0014]-[0017]. Cable 10 may include one QSFP+ end for plugging into a first transceiver 12 and across the cable four SFP+ ends for plugging into four transceivers 14a-14d. Tang, [0017]-[0019], Fig. 1A (below).

Fayed, ¶¶250-251.



In one variation, cable 10 includes SFP+ ends 22k/22l on each side, connected by twinaxial copper cable 18a. Tang, Fig. 6 (below), [0045]-[0047]. Each SFP+ end 22k/22l has two “signal drivers 44 (e.g., CDR)”’: one to handle an inbound data stream that is received from a host and transmitted over the cable, and the other to handle an outbound data stream transmitted from the cable to the host. Tang, [0045]; [0037] (defining “CDR” as clock and data recovery). Fayed, ¶¶252-253.

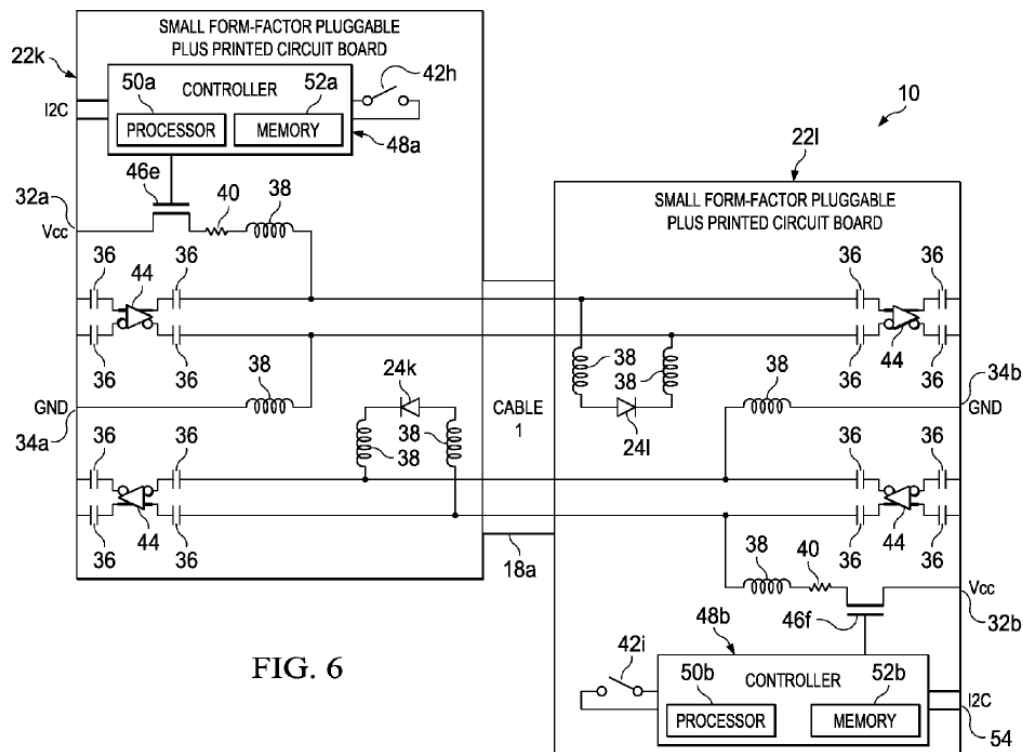


FIG. 6

## B. TI-Retimer

TI-Retimer is a Texas Instruments DS125DF1610 retimer chip datasheet, published March 2017. TI-Retimer, 1; EX1009, ¶¶3-6, Ex. B. The DS125DF1610 is a “9.8 to 12.5 Gbps 16-Channel Retimer.” TI-Retimer, 1. The retimer signal

conditioning features include a continuous time linear equalizer (CTLE), CDR, and transmit FIR filter for each of its sixteen channels. TI-Retimer, §§3, 7. Each channel supports differential input and output signals. TI-Retimer, 13-14, Figs. 1-2 (differential input/output), §7.3.2 (differential receiver input), 19, §7.3.8 (differential driver output); Fayed, ¶254. Figure 2 (below) illustrates the data path for a single channel from received input signal IN, through the CTLE (labelled “EQ”), CDR, and FIR Filter, before being output as signal OUT. Fayed, ¶254.

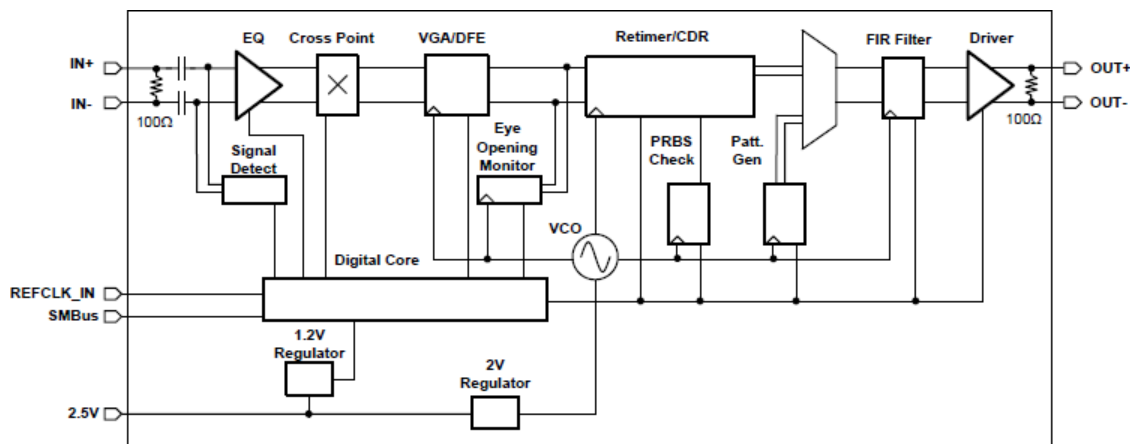


Figure 2. DS125DF1610 Simplified Data Path Diagram

The signal conditioning features “enhance... robustness over long, lossy, crosstalk impaired high speed serial links,” such as “lossy copper interconnects and backplanes.” TI-Retimer, §§3, 7.3.3 (CTLE is an “equalizer”), 7.3.6 (“equalized data is fed into the CDR for clock and data recovery” and “recovered data is then output to the FIR filter”), 7.3.8 (FIR filter “assist[s] with transmit equalization”); Fayed, ¶¶255-256.

## **C. Tang+TI-Retimer+Aronson Combination**

### **1. Tang/TI-Retimer**

Tang's active Ethernet data cable has signal drivers 44 that include, *e.g.*, CDR. Tang, Abstract, [0014]-[0017], [0045]-[0047]. Tang does not describe how to implement signal drivers 44 and other aspects of the cable; therefore, a POSA implementing Tang's cable would have had reasons to implement Tang's signal drivers 44 using known components. Tang, [0052]; Fayed, ¶259.

POSAs had reasons to use TI-Retimer's chip to implement Tang's signal driving circuits 44. Fayed, ¶260; EX1030, 2-7 (use of TI-Retimer's DS125DF1610 chip in active copper cables). Tang describes "data cable 10" for 10 Gb "Ethernet connectivity" (Tang, [0016]), which TI-Retimer supports (TI-Retimer, 1, 10 (§6.6, input data rate)). Fayed, ¶260. TI-Retimer describes a signal driving circuit of the type used in Tang and was well-suited to use in Tang's active cable because TI-Retimer's chip has the CDR signal processing Tang describes (Tang, [0037]) and "enhance[s]... robustness over long, lossy, crosstalk impaired high speed serial links," such as "lossy copper interconnects and backplanes" (TI-Retimer, §3), which POSAs understood describe the line-side and host-side connections for the transceivers in the connectors of Tang's active cable. Fayed, ¶¶260, 273.

Additionally, POSAs knew that standard-based connectors like Tang describes were customizable with various circuitry, including filters, amplifiers,

transceivers, and other “active” components. Fayed, ¶261; Ayzenberg, [0065], [0099]. Thus, implementing Tang’s signal driver 44 using TI-Retimer’s chip would have been nothing but a “simple substitution of one known element [TI-Retimer’s chip] for another [Tang’s signal driver 44]” to obtain predictable results [Tang’s cable using TI-Retimer’s chip to implement signal driver 44]. *KSR*, 550 U.S. at 417-418. This combination is nothing more than an “application of a known technique [TI-Retimer’s chip] to a piece of prior art ready for improvement [Tang’s cable, relying on POSA’s knowledge of how to implement signal driver 44]” to yield predictable results [Tang’s cable using TI-Retimer’s chip to implement signal driver 44]. *KSR*, 550 U.S. at 417-418; Fayed, ¶261.

In Figure 6 below, the Tang/TI-Retimer combination uses a channel of TI-Retimer’s chip for each transmit or receive channel in Tang’s connectors (“Form Factor Pluggable), with one TI-Retimer chip channel handling the inbound data stream (highlighted yellow below) from the host and the other (shown upside down below) handling the outbound data stream (highlighted blue below) to the host. Fayed, ¶262.

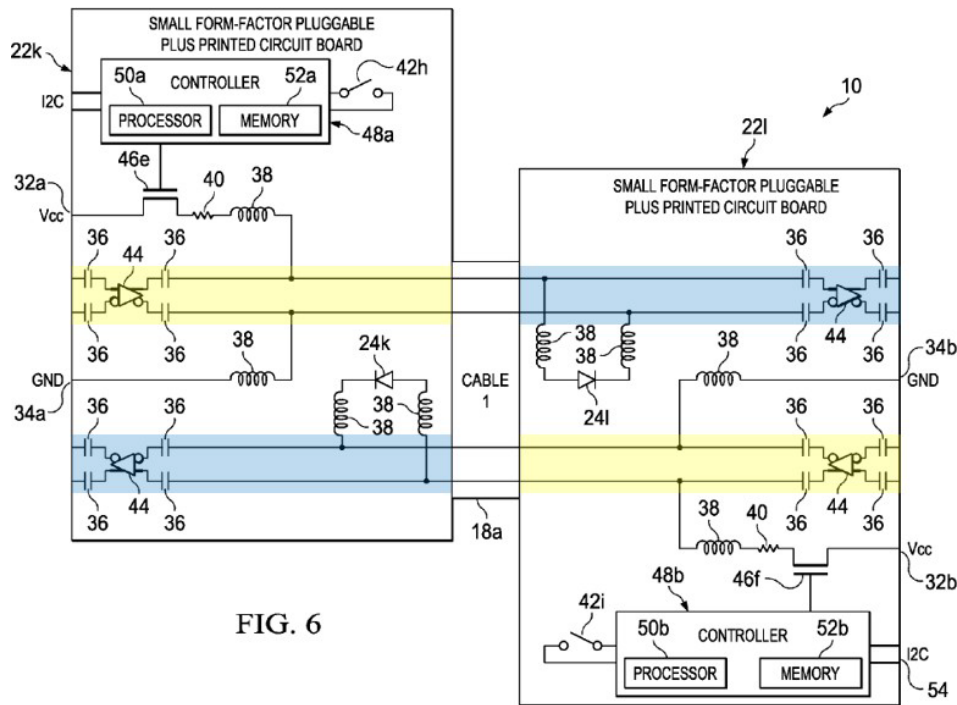


FIG. 6

While this analysis references Tang’s Figure 6 for simplicity (showing two channels analogous to the ’252 claims), POSAs would have found the TI-Retimer chip advantageous for single-chip implementation in any of Tang’s embodiments (or variations thereof) with additional channels (*e.g.*, Tang Figure 1A-1B’s “quad” ends process eight channels each). Tang, [0017]-[0018]; Fayed, ¶¶263-264.

## 2. Further Modifications Based on Aronson and a POSA’s Background Knowledge

### a. Fixed Cable-Independent Parameters for Host-Side Equalization

In the Tang/TI-Retimer combination figures shown *supra* §VII.C.1, the equalizer EQ in the channel handling the yellow-highlighted data stream performs equalization on inbound signals from the host, and the FIR filter in the channel

handling the blue-highlighted data stream performs pre-equalization on outbound signals transmitted to the host. Fayed, ¶265.

For the same reasons discussed *supra* §VI.C.1 concerning host-side equalization and pre-equalization in Lugthart-993, POSAs would have implemented the host-side equalization (via the yellow-highlighted EQ) and the host-side pre-equalization (via the blue-highlighted FIR Filter) in Tang/TI-Retimer by using fixed cable-independent parameters to address host-side losses as taught by Aronson and numerous references corroborating a POSA's background knowledge. Fayed, ¶266.

#### **b. Cable-Dependent Parameters for Line-Side Equalization**

In the Tang/TI-Retimer combination figures *supra* §VII.C.1, equalizer EQ in the blue-highlighted signal processing channel equalizes line-side signals received from across the cable from the other connector, and the FIR filter in the yellow-highlighted signal processing channel pre-equalizes signals transmitted across the cable to the other connector. Fayed, ¶267.

For the same reasons discussed *supra* §VI.C.2 concerning Lugthart-993's line-side equalization and pre-equalization, POSAs would have implemented the line-side equalization (via the blue-highlighted EQ) and the line-side pre-equalization (via the yellow FIR Filter) in Tang/TI-Retimer by using cable-dependent parameters to address cable-side losses as taught by Aronson and

numerous references corroborating a POSA's background knowledge. Fayed, ¶268.

**c. Adapting the Line-Side Cable-Dependent Parameters**

For the same reasons discussed *supra* §VI.C.2.a concerning Lugthart-993's line-side equalization and pre-equalization, POSAs had reasons to use adaptive cable-dependent parameters for the line-side equalization (via the blue-highlighted EQ) and line-side pre-equalization (via the yellow FIR Filter) in Tang/TI-Retimer as taught by Aronson and numerous references corroborating a POSA's background knowledge of the desirable design choice option of using adaptive equalization parameters. Fayed, ¶269. This adaption would have been obvious to perform during TI-Retimer's CDR lock acquisition process—*i.e.*, during an adjustment period. TI-Retimer, §7.3.3 (CTLE adaption); Fayed, ¶269.

**d. Line-Side Cable-Dependent Parameters Determined During Manufacturing-Testing and Fixed During Normal Usage**

For the same reasons discussed *supra* §VI.C.2.b concerning Lugthart-993's line-side equalization and pre-equalization, POSAs had reasons to determine the cable-dependent parameters for the line-side equalization (via the blue-highlighted EQ) and line-side pre-equalization (via the yellow FIR Filter) in Tang/TI-Retimer during manufacturing-testing and then fix those parameters during normal usage, as taught by Aronson and numerous references corroborating a POSA's background

knowledge of the desirable design choice option of using adaptive equalization parameters. Fayed, ¶270.

### **3. Reasonable Expectation of Success**

POSAs would have had a reasonable expectation of success in implementing Tang/TI-Retimer in any and all of the ways discussed *supra* §§VII.C.2.a-VII.C.2.d. As shown §§VI.C.1-VI.C.2.b and VII.C.2.a-VII.C.2.d, Aronson and other references corroborating a POSA's background knowledge demonstrate that each above-discussed design choice was well-known. Implementing these well-known techniques for use in active cables like Tang's, using signal processing circuits like TI-Retimer's, was well-within a POSA's capabilities. This Tang/TI-Retimer in view of Aronson is "Tang+TI-Retimer+Aronson." Fayed, ¶¶271, 273.

POSAs understood that TI-Retimer worked with, or without, adaptation because it provides configurable settings for enabling/disabling adaptation. TI-Retimer, §7.5, Address 31 (describing a setting for "no adaption" of the CTLE). If every TI-Retimer equalization component does not specifically implement selectable fixed and adaptive equalization, the known benefits of fixed and adaptive equalizers provided reasons to implement that functionality, as discussed above. *E.g.*, *supra* §§VI.C.1-VI.C.2.b. Tang+TI-Retimer+Aronson, with compensation for the host, compensation for the cable, and fixed or adaptive

equalization, would have required no more than a POSA's ordinary skill. Fayed,  
¶272.

## D. Claim 1

### 1. Preamble

Tang+TI-Retimer+Aronson meets [1.PRE] because Tang's cable 10 is an  
“active twinaxial cable” with SFP+ ends for “ten (10) Gigabit Ethernet  
connectivity.” Tang, Fig. 6 (below, showing cable 10), [0016], [0045]; Fayed,  
¶274.

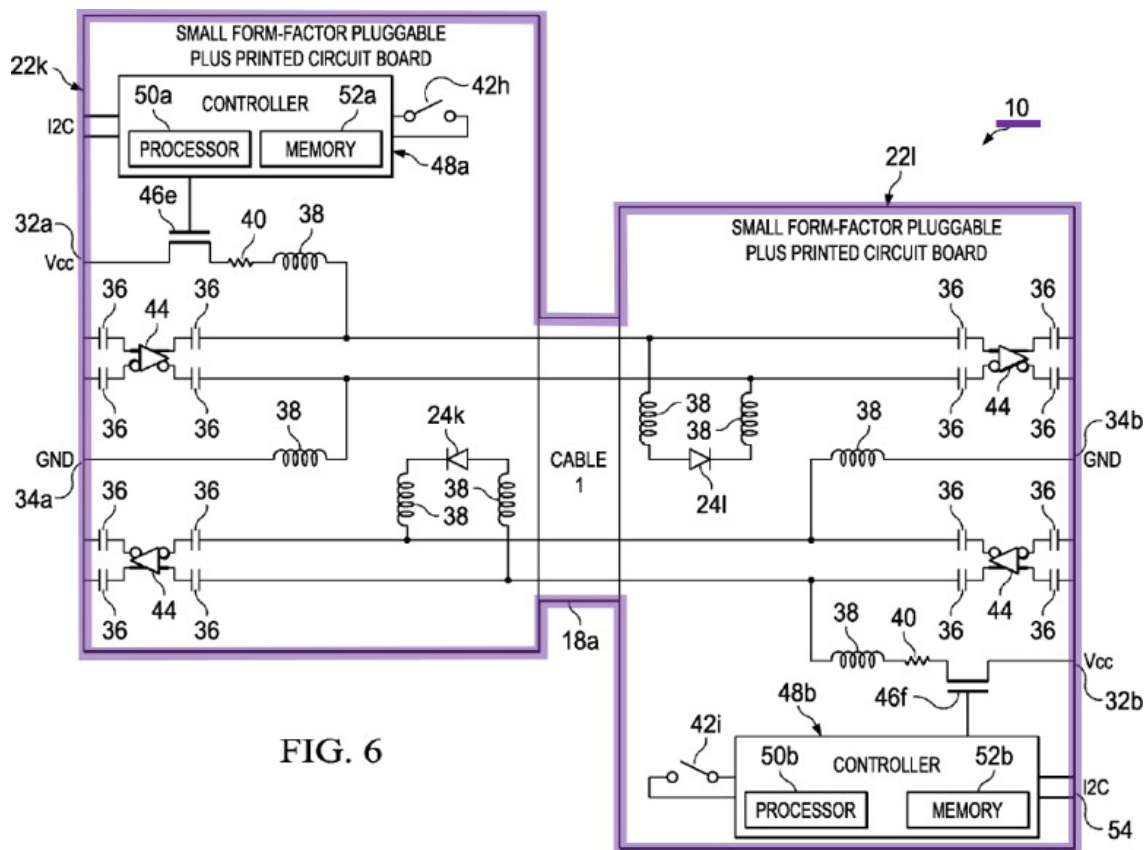
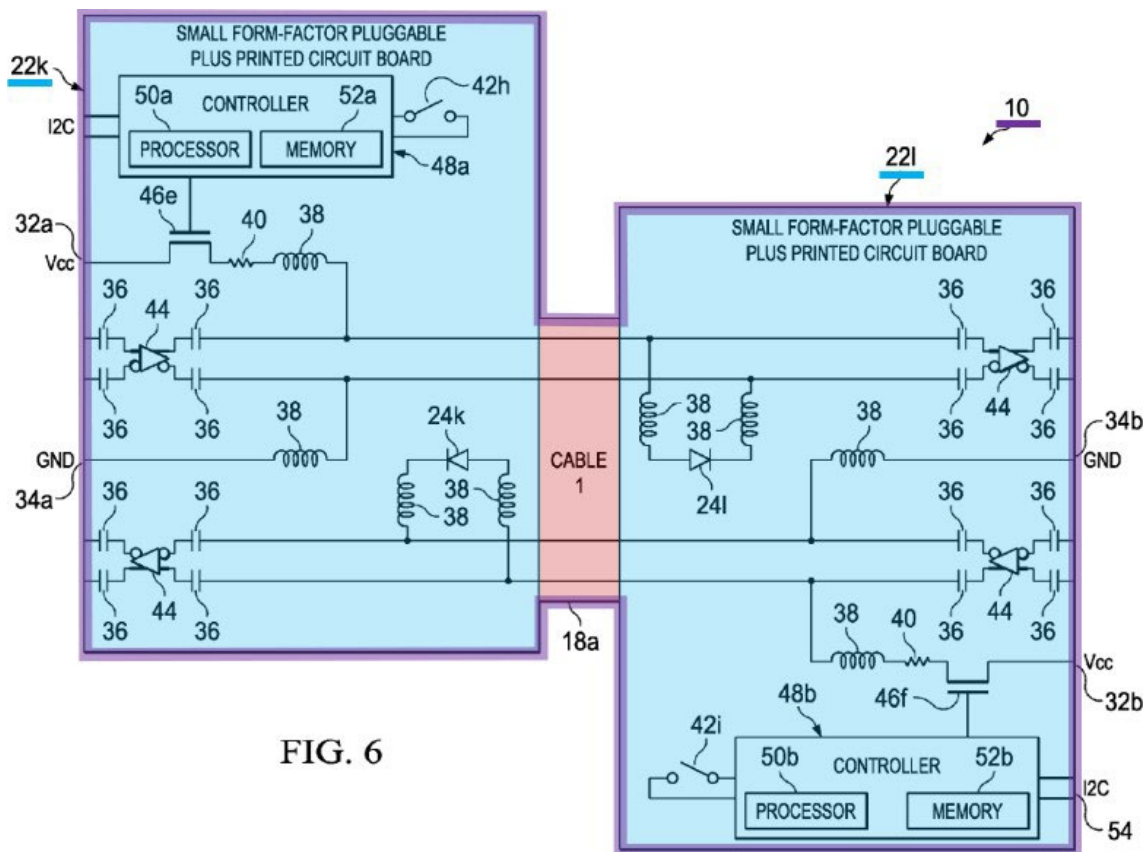


FIG. 6

## 2. Limitation [1.A]

Tang+TI-Retimer+Aronson meets [1.A] because cable 10 has *electrical conductors* (twinaxial copper cable 18a) connected between a first connector (SFP+ end 22k) and a second connector (SFP+ end 221). Tang, Fig. 6 (below), [0015] (“small form-factor pluggable plus (SFP+) end”), [0045]-[0047] (current flows through cable 18a); Fayed, ¶¶275-276.



## 3. Limitation [1.B.i]

Tang+TI-Retimer+Aronson meets [1.B.i] because *each of the first and second connectors* (SFP+ ends 22k/221) is adapted to fit into an Ethernet port of a corresponding host device. SFP+ ends 22k/221 are adapted to connect to “SFP+

end housing[s]” (*i.e.*, ports) of transceivers 12/14, respectively. Tang, [0046]-[0047], Fig. 1A (below), Fig. 6. Transceivers 12/14 correspond to respective host devices, like a server, router, or switch. Tang, [0002], [0021], [0026]-[0028] (SFP+/QFP assemblies “plugged [in/into]” cages, racks, and housings). “*Ethernet port of a corresponding host device*” comprises a port that receives these industry-standard SFP connectors. *Supra* §VI.D.3 (discussing *Ethernet port*); Fayed, ¶¶227-278. POSAs understood that Tang’s SFP+ cable connectors (or modules) fit into ports of the corresponding host device transceivers. Fayed, ¶278; EX1027, 1 and 11 (modules are plugged into and retained inside port cages), 7 (illustrating an SFP+ module and cage), 18 (examples of one-port and two-port transceiver cages).

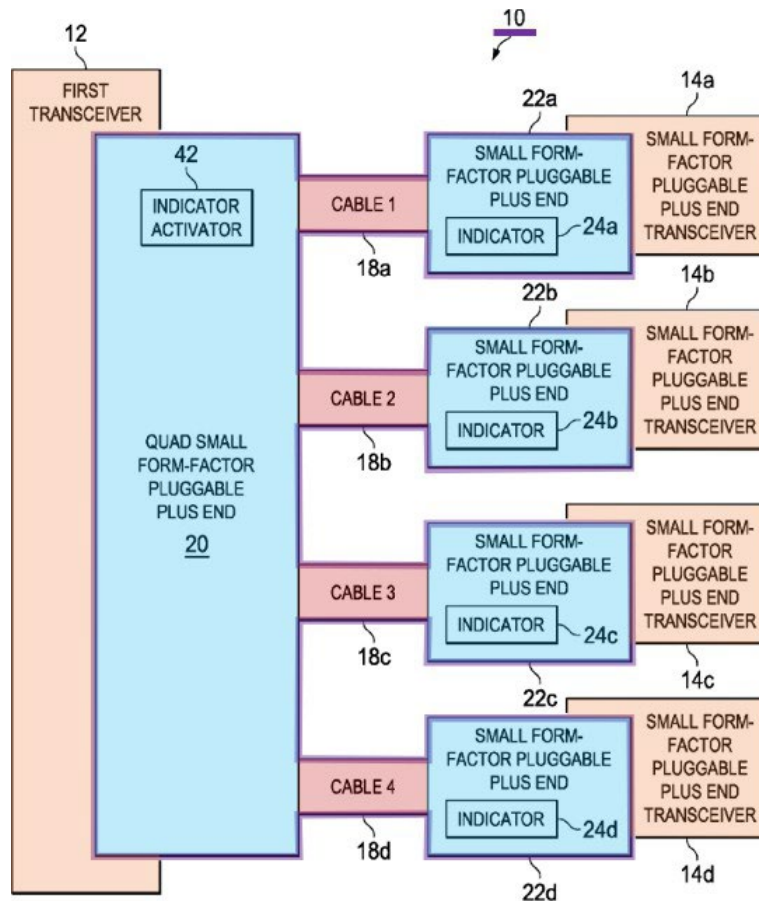


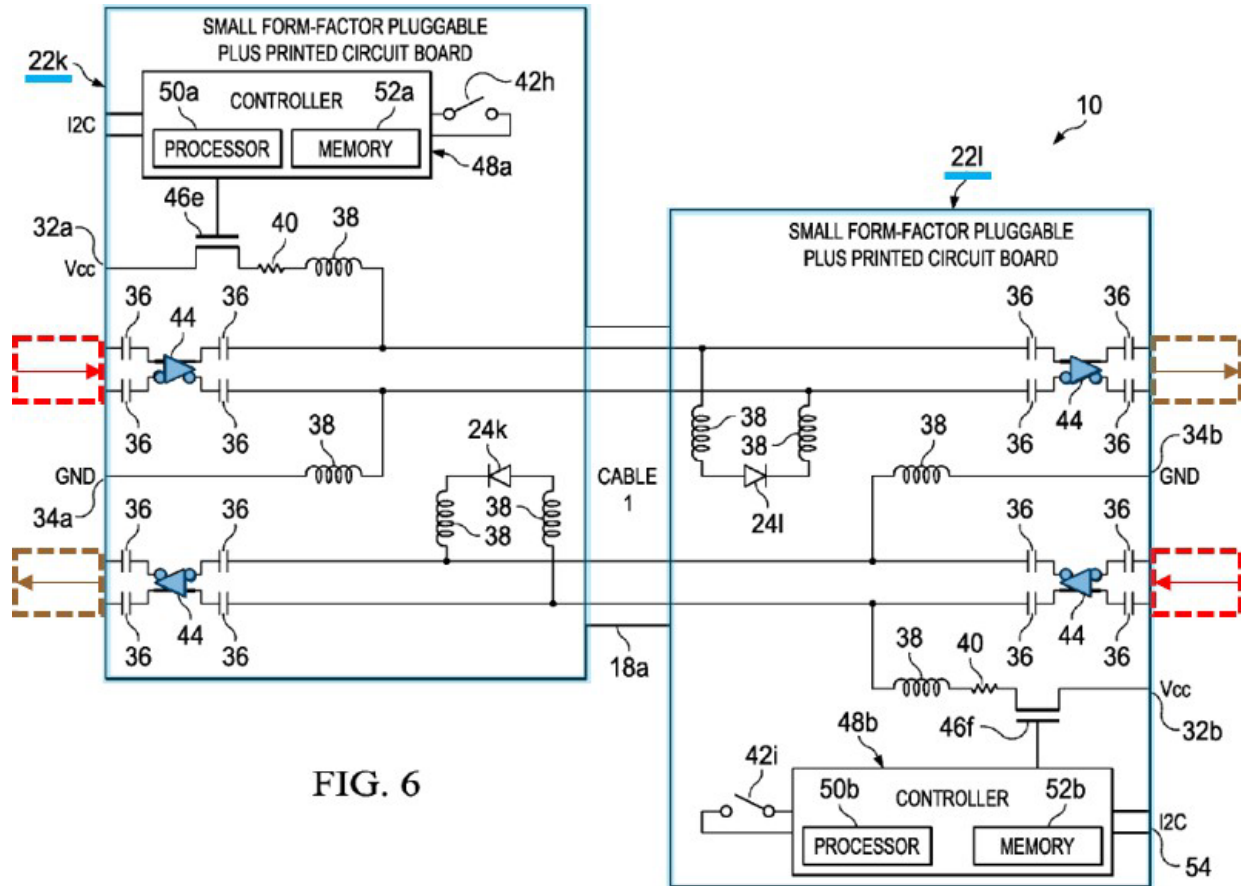
FIG. 1A

#### 4. Limitation [1.B.ii]

Tang+TI-Retimer+Aronson's Ethernet cable 10 facilitates bidirectional communication between two connected host devices. Fayed, ¶280; EX1028, 54 (“This standard defines Ethernet local area, access and metropolitan area networks.”), 55 (“Full duplex operation allows simultaneous communication between a pair of stations.”).

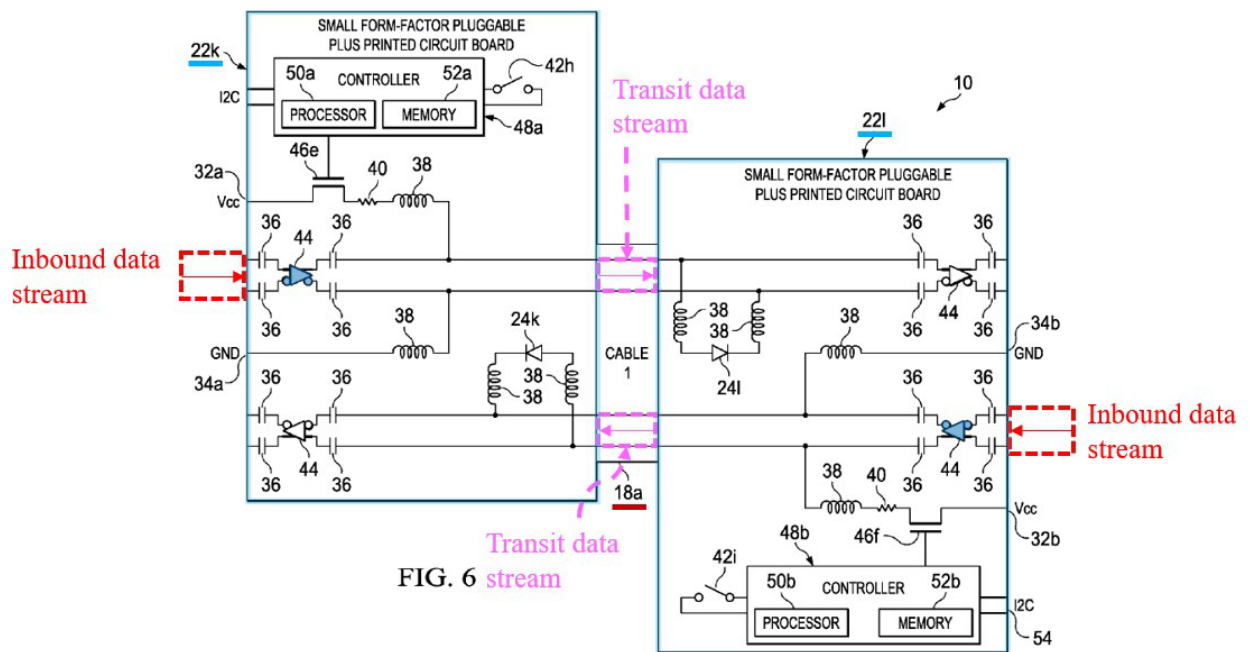
Tang's SFP+ ends 22k/22l each includes at least two signal drivers 44 handling data flows in opposite directions. Tang, [0045], Fig. 6. Tang Fig. 6 (below) shows one upper data stream flowing from the host on the left to the host

on the right and another lower data stream flowing in the opposite direction, with both data streams conveyed by electrical signals. Fig. 6 illustrates that Tang+TI-Retimer+Aronson meets [1.B.ii] because *each of the first and second connectors (SFP+ ends 22k/22l) receives an electrical signal conveying an inbound data stream to the cable from its connected host and provides to that host an electrical output signal conveying an outbound data stream from the cable*. Fayed, ¶¶281-282.



## 5. Limitation [1.C]

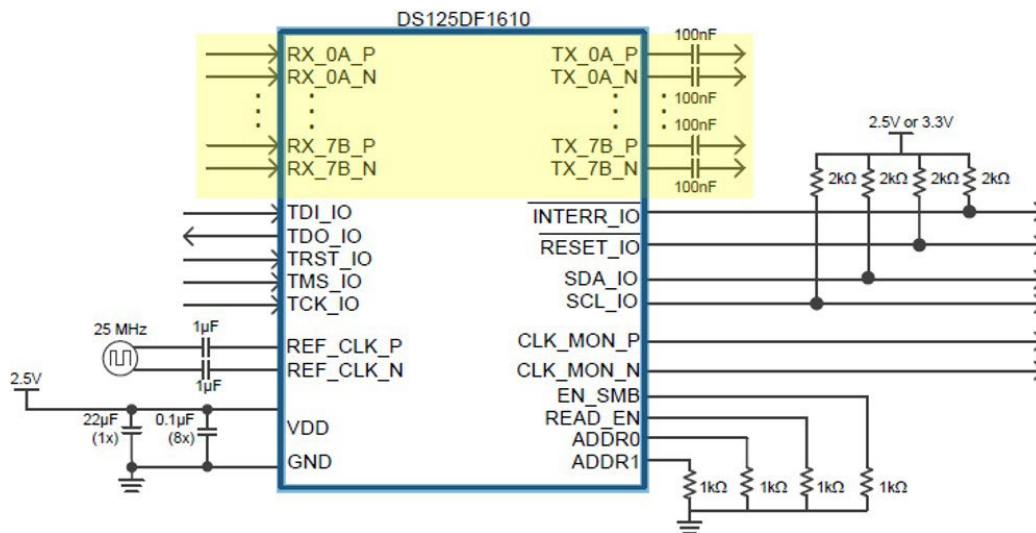
Tang+TI-Retimer+Aronson meets [1.C] because *each of the first and second connectors (SFP+ ends 22k/221) includ[es] a respective transceiver (TI-Retimer's retimer that implements Tang's signal driver 44) that performs CDR on the electrical input signal to extract and remodulate the inbound data stream for transit via the electrical conductors as a respective electrical transit signal conveying a transit data stream as shown in Fig. 6 (below). Fayed, ¶283; supra §VII.C (describing the combination).*



TI-Retimer's retimer is illustrated in the Simplified Schematic and Figure 1 below. The highlighted pins illustrate sixteen channels of data, with each channel having two differential (Positive and Negative) input pins (RX\_0A\_P/N through RX\_7B\_P/N) to receive the channel of data and corresponding output pins

(TX\_0A\_P/N through TX\_7B\_P/N) to transmit the channel of data after processing. TI-Retimer, §3, 7.2. Thus, TI-Retimer's retimer is a transceiver that, when used in Tang's cable, receives one or more inbound data streams (on RX\_0A\_P/N through RX\_7B\_P/N), and transmits one or more transit data streams (via pins TX\_0A\_P/N through TX\_7B\_P/N). Fayed, ¶284.

### Simplified Schematic



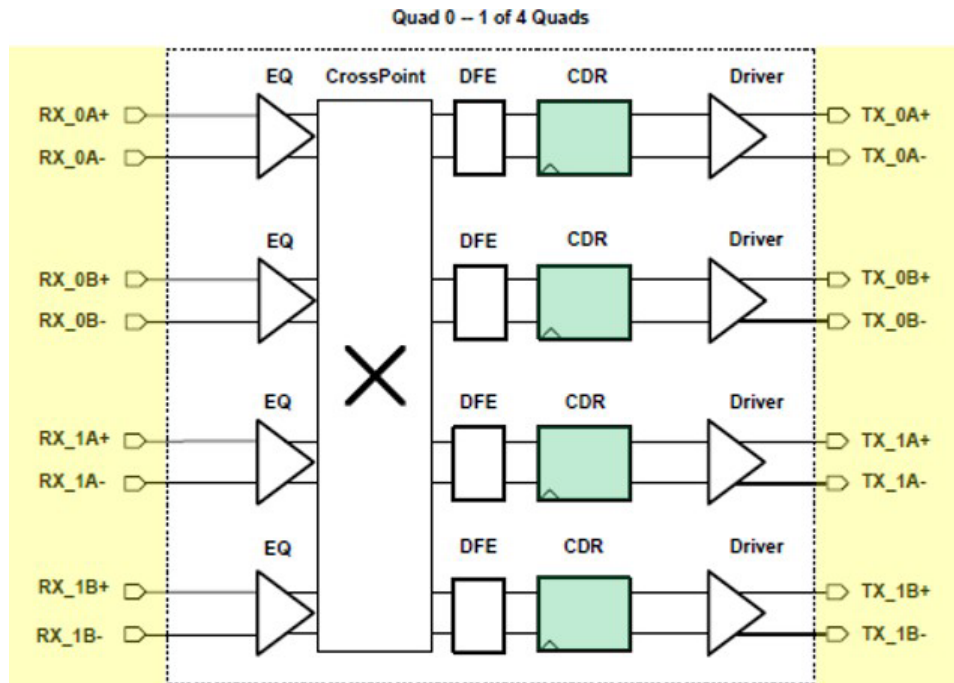


**Figure 1. DS125DF1610 Simplified Cross Point Diagram**

Figure 1 above shows four channels and illustrates that TI-Retimer’s retimer processes each data channel by, *inter alia*, performing “clock and data recovery (CDR).” TI-Retimer, §§3, 7.1; Fayed, ¶285. A channel’s data path is shown in more detail in TI-Retimer Figure 2 (below), which illustrates the input signal conveying an inbound data stream and the transit signal conveying a transit data stream in Tang’s cable when TI-Retimer’s retimer implements Tang’s signal driver

44. Fayed, ¶285.

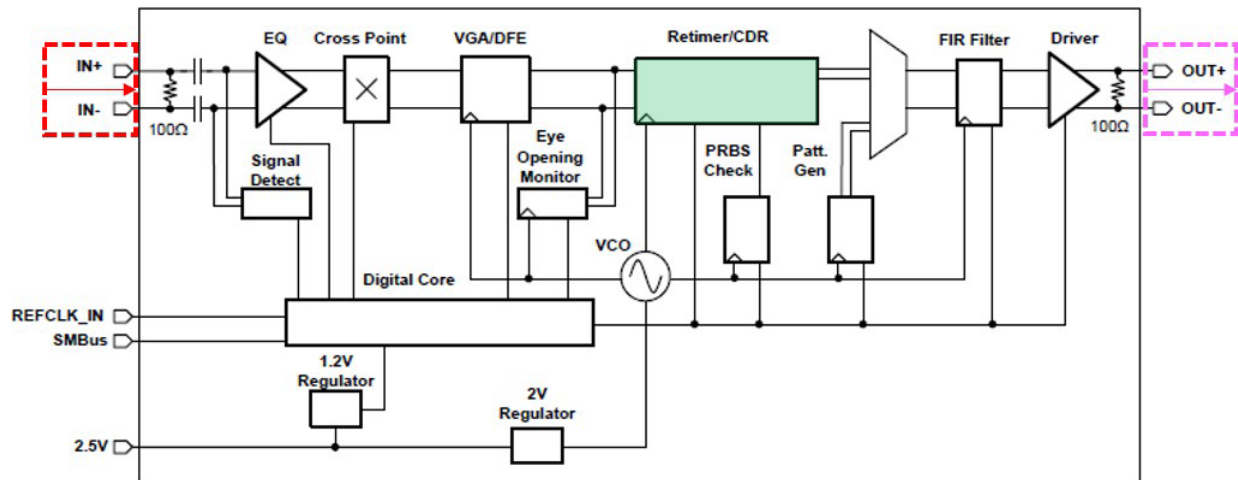


Figure 2. DS125DF1610 Simplified Data Path Diagram

The Retimer/CDR circuit performs clock and data recovery on the electrical input signal to extract and re-modulate the inbound data stream for transit via the electrical conductors as a respective electrical transit signal conveying a transit data stream. TI-Retimer, §7.3.6. As discussed *supra* §VI.D.5 (Ground 1 [1.C]), the '252 Patent specification makes clear that the input signal from the host can be pre-processed before CDR is performed on it. Fayed, ¶286.

POSAs understood that TI-Retimer's retimer remodulates the data for output as the transit data stream because, after extracting the input signal's timing and using that timing to sample and extract the input signal's data in an analog-to-digital CDR process, the retimer generates a new data stream for equalization by the FIR Filter (a digital-to-analog process) and to be driven for output by the differential driver (which produces an analog signal with configurable output voltage levels) to convey the output data stream (transit data stream when outputting over the cable) as an analog signal over the cable conductors, where the new signal is a “re-

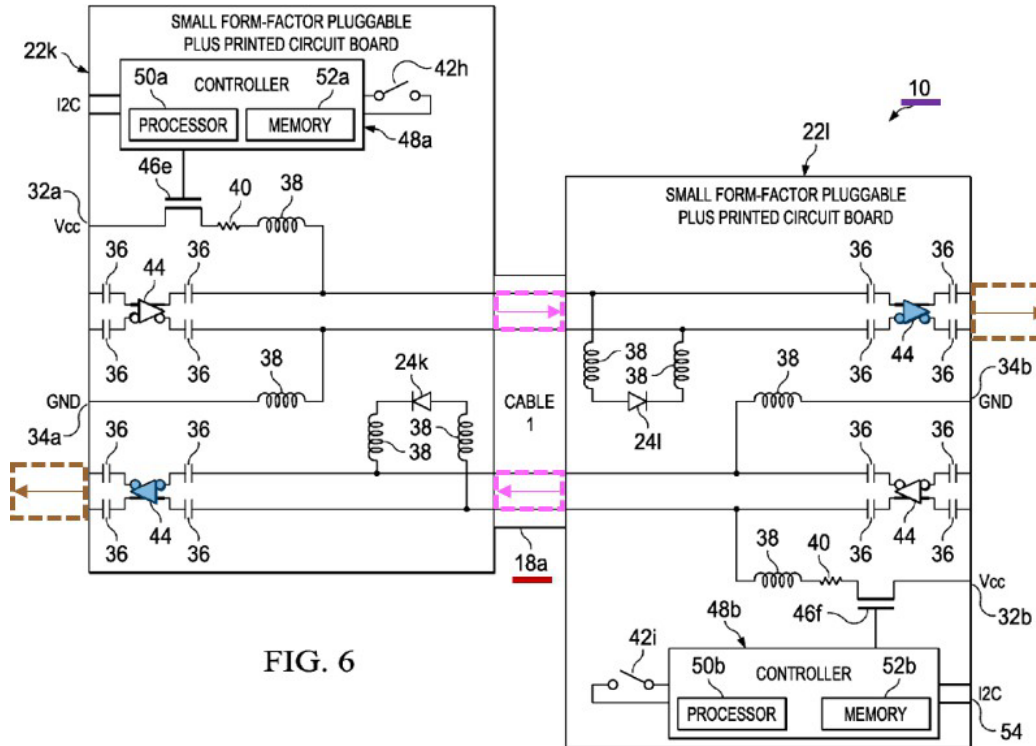
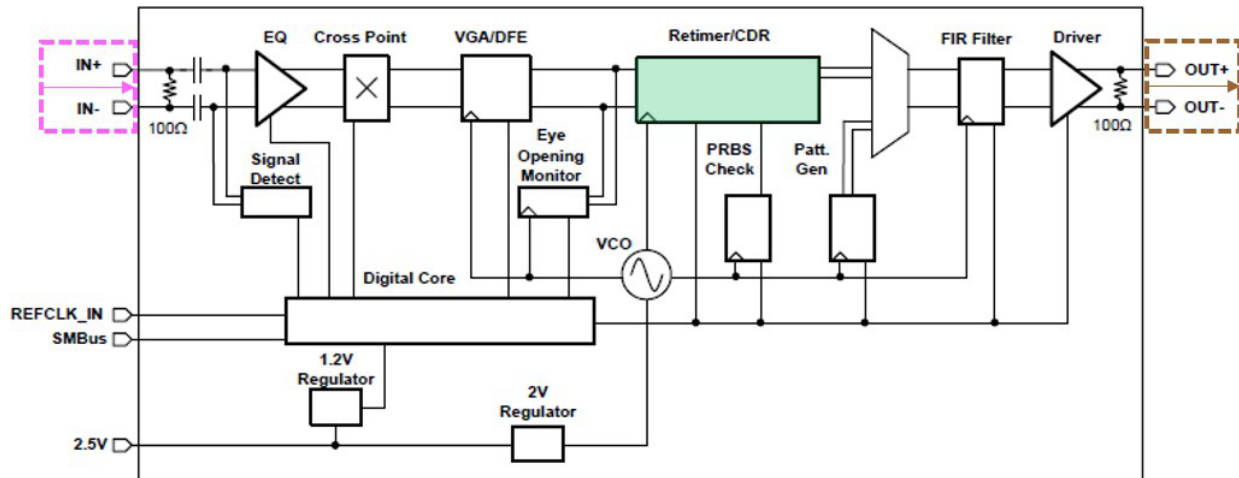
*modulation*” of the data. TI-Retimer, §§7.3.6-7.3.9; Fayed, ¶¶91-105, 287. PO has likewise admitted that “retiming” extracts and re-modulates signals. EX1039, 11-17 (“retiming’... to extract and re-modulate”). To the extent TI-Retimer is considered to not expressly disclose this, that would have been the conventional and obvious way to implement what TI-Retimer discloses. Fayed, ¶¶287-288.

## 6. Limitation [1.D]

Tang+TI-Retimer+Aronson meets [1.D] because *the respective transceiver* (TI-Retimer’s retimer implementing Tang’s signal driver 44) *for each of the first and second connectors* (SFP+ ends 22k and 221) *perform[s] CDR on the respective electrical signal to extract and re-modulate the transit data stream as the outbound data stream from the cable* as shown in Fig. 6 (below). Fayed, ¶289; *supra* §VII.C (describing the combination).

TI-Retimer’s retimer implementing Tang’s **signal driver 44** (highlighted blue below) performs CDR for respective **transit signals conveying transit data streams** received from **cable 18a** (electrical conductors) to generate **output signals** **conveying outbound data streams** that exit **cable 10** to respective hosts, as shown in Tang Figure 6 and TI-Retimer Fig. 2. below. For similar reasons to those discussed *supra* §VII.D.5 ([1.C]), POSA’s understood that TI-Retimer’s retimer remodulates the data as the **outbound data** after extracting the input signal’s data and generating a newly-timed signal that is a “*re-modulation*” of the data, or that

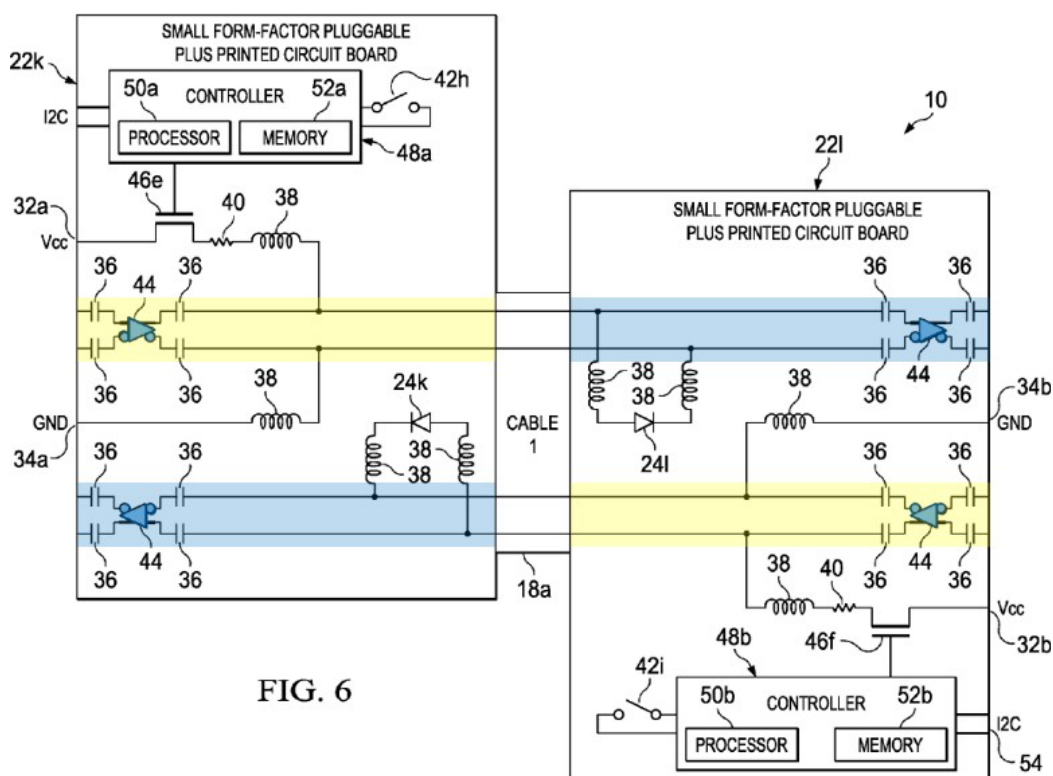
would have been the conventional and obvious way to implement what TI-Retimer discloses. EX1039, 11-17 (discussed §VII.D.5 *supra*); Fayed, ¶¶290-291.



## 7. Limitation [1.E]

Tang+TI-Retimer+Aronson's *transceivers* (TI-Retimer's retimer) each performs equalization *for the remodulation of the transit data stream as the outbound data stream* (by the retimer's FIR filter) and *for the [CDR] performed on the electrical input signal* (by the retimer's EQ), both using *fixed cable-independent parameters*. Fayed, ¶292.

As explained *supra* §§VII.C (explaining the combination), VII.D.5 ([1.C]) and VII.D.6 ([1.D]), in Tang+TI-Retimer+Aronson, TI-Retimer's retimer implements Tang's signal driver 44 and handles both the inbound data stream and the outbound data stream as highlighted blue and yellow, respectively, in Tang Fig. 6 below. Fayed, ¶293.



TI-Retimer's Figure 2 is annotated twice below: once to show the retimer processing the inbound data stream (top) and again to show the retimer processing the outbound data stream (bottom). In the top (inbound) use case below, EQ equalizes an input signal from a host transceiver for Retimer/CDR circuit. TI-Retimer, §7.3.3. In the bottom (outbound) use case, FIR Filter equalizes the remodulated signal provided as the output signal transmitted to a host transceiver TI-Retimer §§3, 7.3.8; Fayed, ¶293. Equalizing the inbound signal before performing CDR and pre-equalizing the remodulated signal before transmitting it to the host meets “employing ... equalization parameters for each of the remodulation of the transit data stream as the outbound data stream, and the [CDR] performed on the electrical signal” as a matter of claim construction for the same reasons discussed *supra* §VI.D.7 (Ground 1, [1.E]).

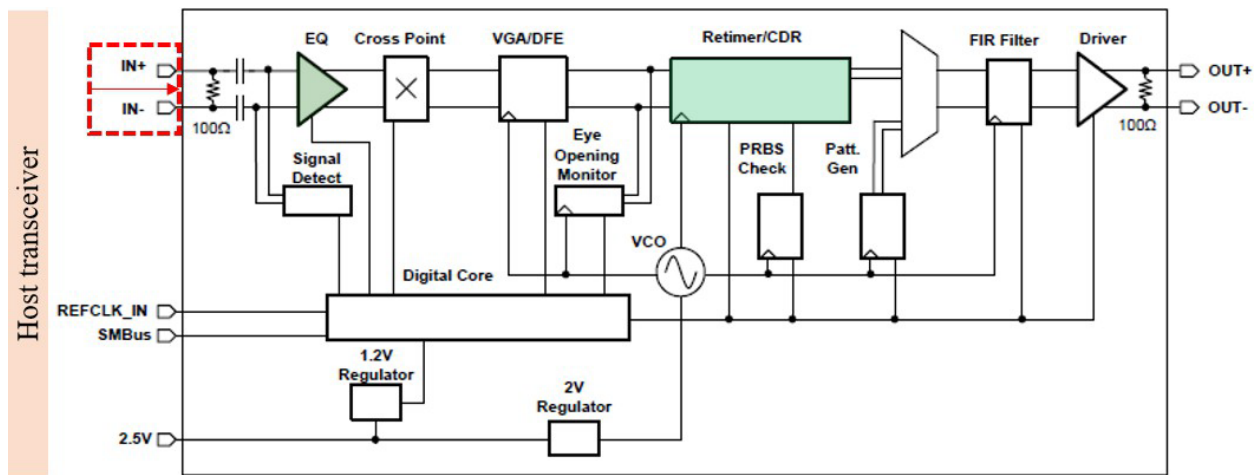


Figure 2. DS125DF1610 Simplified Data Path Diagram

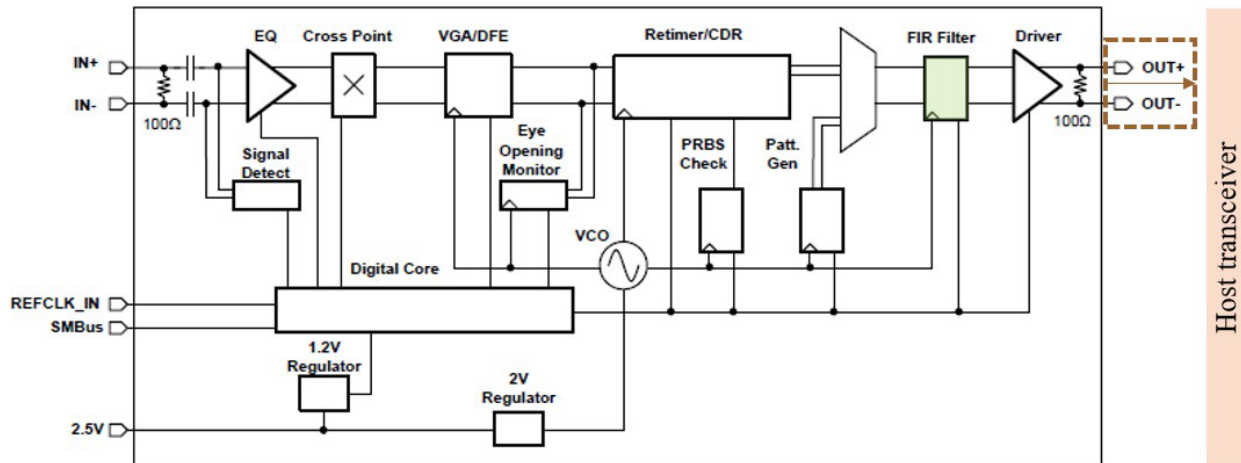


Figure 2. DS125DF1610 Simplified Data Path Diagram

As discussed *supra* §VII.C.2.a, in the Tang+TI-Retimer+Aronson combination the host-side equalization (performed by EQ) and pre-equalization (performed by FIR Filter) use fixed cable-independent parameters to address host-side losses as taught by Aronson and numerous references corroborating a POSA's background knowledge. Fayed, ¶¶295-296; Aronson, 12:10-17, 14:16-23, 15:17-24.

### E. Claim 2

Tang+TI-Retimer+Aronson's *transceivers* (TI-Retimer's retimer) *each employ cable-dependent equalization parameters for at least one of: the remodulation of the inbound data stream for transit* (by the retimer's FIR filter) *and the [CDR] performed on the electrical input signal* (by the retimer's EQ). Fayed, ¶297.

As explained *supra* §§VII.C.2, VII.D.5-6, in Tang+TI-Retimer+Aronson, TI-Retimer's retimer implements Tang's signal driver 44 and is used to handle both

generation of the transit signal across the cable (highlighted yellow) and the receipt of the transit signal over the cable (highlighted blue) in Tang Fig. 6 below.

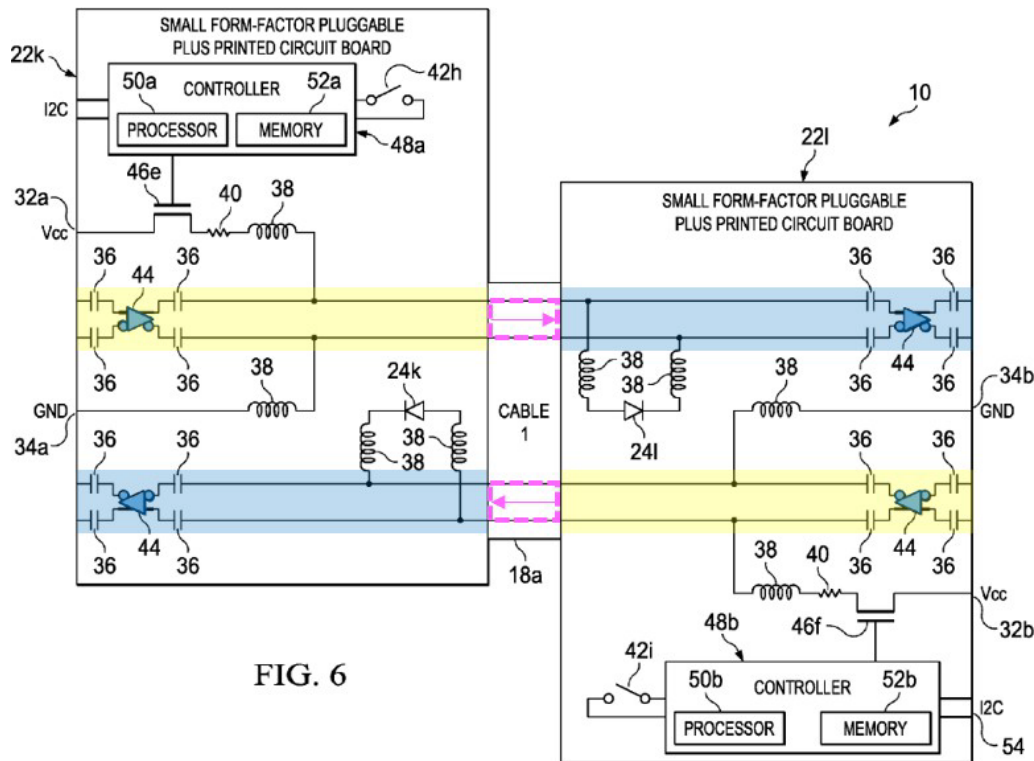


FIG. 6

TI-Retimer's Figure 2 is annotated twice below – once to show the retimer processing the transit signal for transmission over the cable (top) and the other showing the retimer processing the transit signal received from the other side of the cable (bottom). In the top use case, **FIR Filter** equalizes the remodulated signal provided as the **transit signal** transmitted over **cable 18a**. TI-Retimer §§3, 7.3.8. In the bottom use case, **EQ** equalizes the **transit signal** received over **cable 18a** for **Retimer/CDR circuit**. TI-Retimer, §7.3.3; Fayed, ¶¶298-299. Equalizing the transit signal before performing CDR and pre-equalizing the transit signal before

transmission over the cable meets the proper construction of “*employing ... equalization parameters for... the remodulation of the inbound data stream for transit, and the [CDR] performed on the electrical transit signal,*” for the same reasons discussed *supra* §VI.E (Ground 1, claim 2).

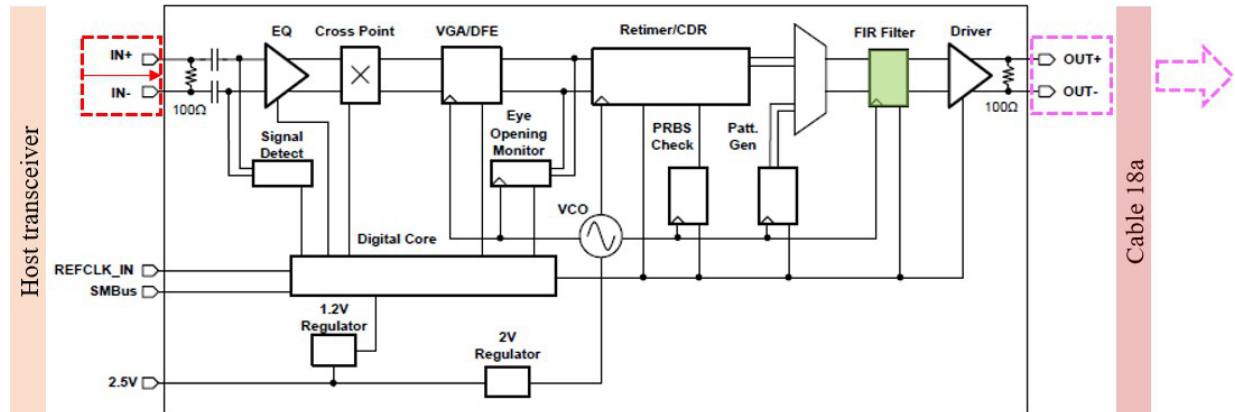


Figure 2. DS125DF1610 Simplified Data Path Diagram

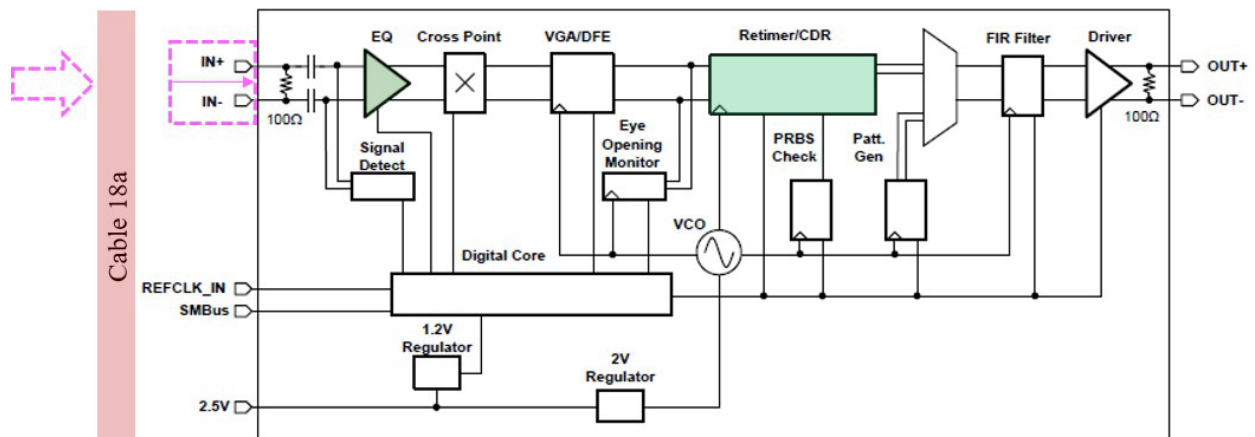


Figure 2. DS125DF1610 Simplified Data Path Diagram

As discussed *supra* §VII.C.2.b, in the Tang+TI-Retimer+Aronson combination, the cable-side equalization (performed by EQ) and pre-equalization (performed by FIR Filter) use cable-dependent parameters to address cable-side

losses as taught by Aronson and numerous references corroborating a POSA's background knowledge. Fayed, ¶¶300-301; Aronson, 14:33-43, 15:1-8.

**F. Claim 3**

As discussed *supra* §VII.C.2.c, in the Tang+TI-Retimer+Aronson combination, *said cable-dependent equalization parameters* used by TI-Retimer's EQ and FIR Filter for cable-side equalization and pre-equalization, respectively (*supra* §VII.E (claim 2)), are *adapt[ed] during usage of the Ethernet cable* as taught by Aronson and numerous references corroborating a POSA's background knowledge. Fayed, ¶¶302-303; Aronson, Figs. 12A-12B, 15:1-8.

**G. Claim 4**

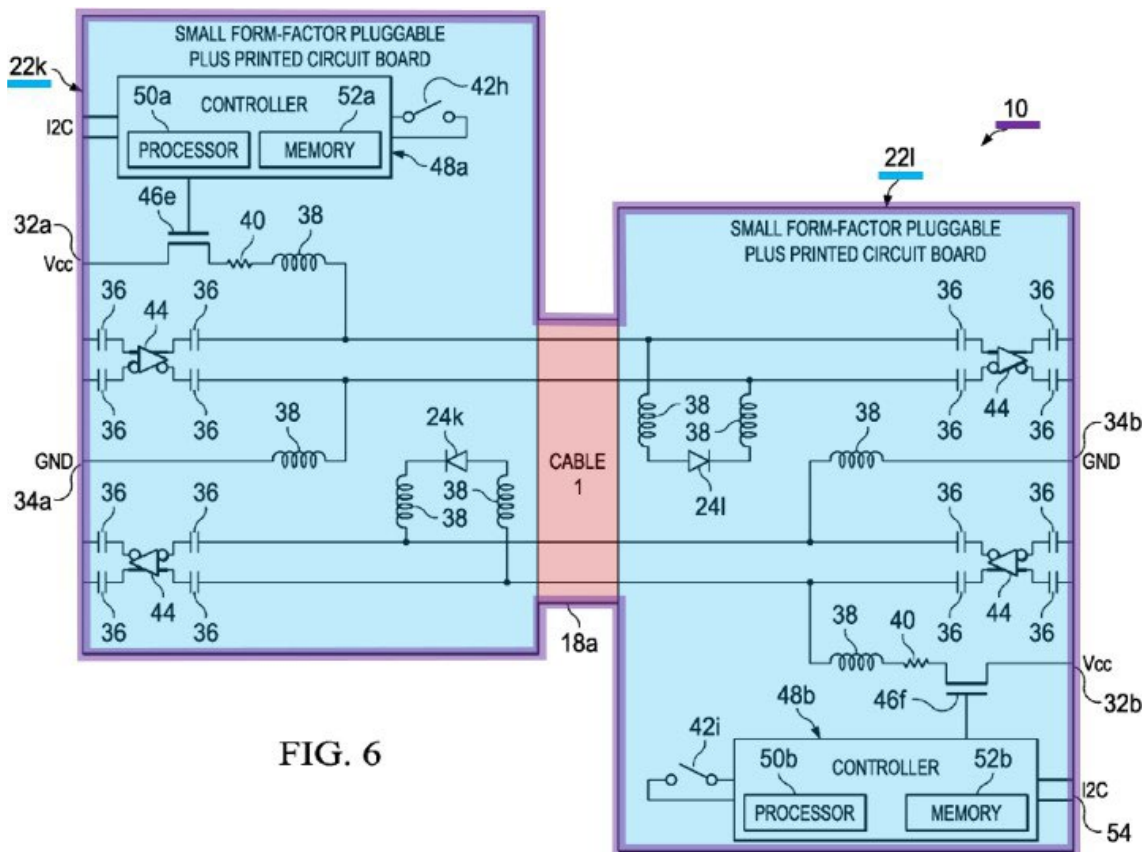
As discussed *supra* §VII.C.2.d, in the Tang+TI-Retimer+Aronson combination, *said cable-dependent equalization parameters* used by TI-Retimer's EQ and FIR Filter for cable-side equalization and pre-equalization, respectively (*supra* §VII.E (claim 2)), are *fixed during normal usage of the Ethernet cable* and *determined during manufacturing-testing of the Ethernet cable* as taught by Aronson and numerous references corroborating a POSA's background knowledge. *Supra* §§VI.C.2.b, VI.F (claim 4); Fayed, ¶¶304-305; Aronson, 14:35-39, 15:4-8, 15:21-23 (describing factory-set cable-dependent equalization parameters).

## H. Claim 6

Claim 6 recites a “communication method” using a “network cable” having limitations mirroring claim 1’s and met for the same reasons. Fayed, ¶306.

### 1. Preamble

Tang+TI-Retimer+Aronson meets [6.PRE] because its cable 10 is used in a communications method meeting all the steps of claim 6 as detailed below, and is a *network (e.g., Ethernet) cable having conductor pairs (twiaxial copper conductors) electrically connecting a first connector (SFP+ end 22k) to a second connector (SFP+ end 22l)*. See *supra* §§VII.D.1-VII.D.2 ([1.PRE], [1.A]), VII.D.4 ([1.B.ii])); Tang, [0015] (“twiaxial copper cable”), Fig. 6 (below); Fayed, ¶307.



## 2. Steps [6.A]-[6.K]

Claim 6 recites cable-performed steps of a communication method where two data streams flow in opposite directions between first and second host devices. Fayed, ¶308.

Tang+TI-Retimer+Aronson's cable is used in such a bi-directional communication method. *Supra* §§VII.C (combination), VII.D (claim 1); Fayed, ¶¶309-310. Simplified Tang Figure 6 (below) shows the two data streams (one blue and one yellow) and claim 6's steps corresponding thereto. The blue stream is a *first inbound data stream from a first host device* that is received by the *first connector* ([6.A]), passed through cable conductors, and conveyed as a *second outbound data stream to the second host device* ([6.B]-[6.C], [6.G]-[6.H], [6.K]. Fayed, ¶310. The yellow stream is a *second inbound data stream from the second host device* that is received by the *second connector* ([6.D]), passed through cable conductors, and conveyed as a *first outbound data stream to the first host device* ([6.E]-[6.F], [6.I]-[6.J]). Fayed, ¶310.

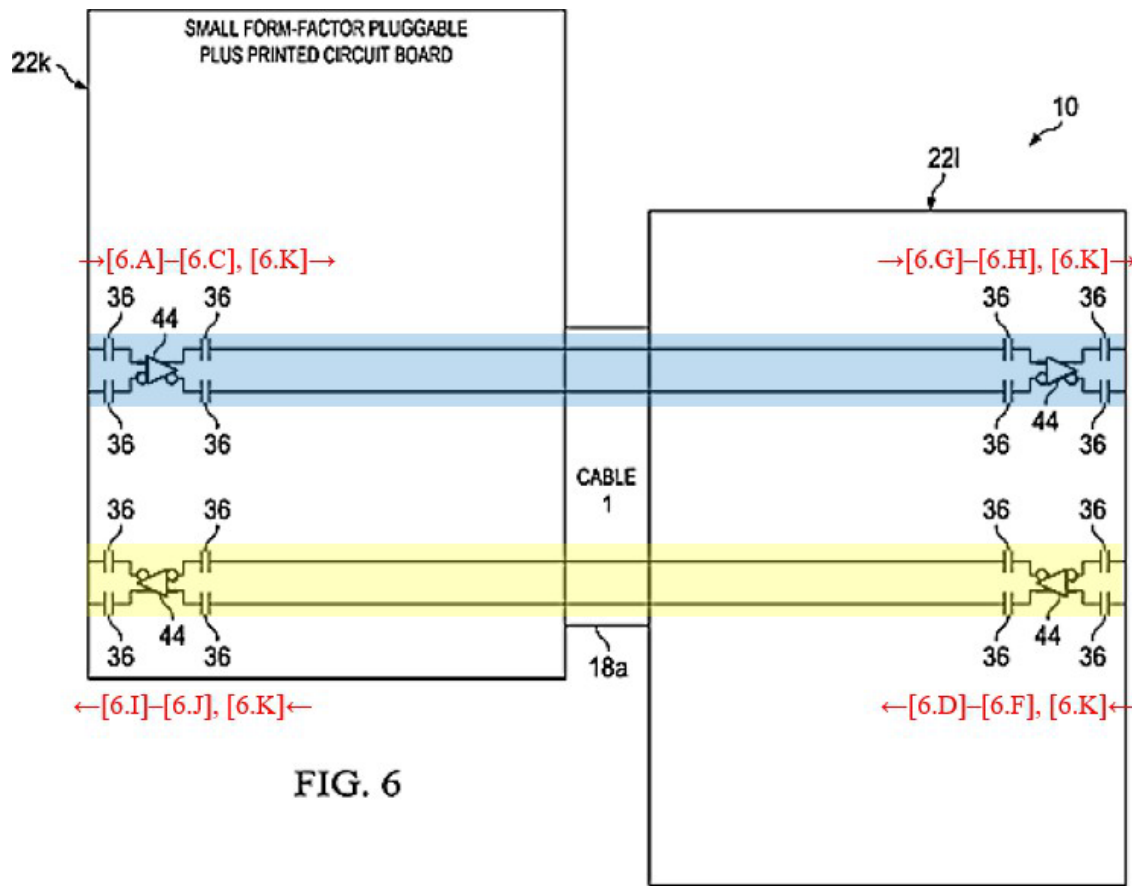


FIG. 6

Steps [6.A]-[6.C] recite the first connector's transceiver *performing CDR* and *re-modulating* the first inbound stream for transmission over the first conductor pair, and [6.D]-[6.F] recite the same steps performed by the second connector's transceiver on the second inbound stream for transmission over the second conductor pair. Tang+TI-Retimer+Aronson meets these steps for the reasons discussed *supra* §VII.D.5 ([1.C]). Fayed, ¶311.

Steps [6.G]-[6.H] recite the second connector's transceiver *performing CDR* and *re-modulating* the blue data stream received over the first conductor pair, and [6.I]-[6.J] recite the same steps performed by the first connector's transceiver on the

(yellow) data stream received over the second conductor pair. Tang+TI-

Retimer+Aronson meets these steps for the reasons discussed *supra* §VII.D.6 ([1.D]).

Fayed, ¶312.

Step [6.K] requires that each of the remodulating and CDR in steps [6.B]-[6.C] and [6.E]-[6.J] employ *fixed, cable-independent, equalization parameters* and is met for the reasons discussed *supra* §VII.D.7 ([1.E]). Fayed, ¶¶313-314.

#### **I. Claim 7**

For the reasons discussed *supra* §VI.J (Ground 1, claim 7), claim 7 should be construed to not include the language highlighted in that section because it was never part of the examined claim. Properly-construed claim 7 introduces limitations substantively identical to claim 2 and is met by Tang+TI-Retimer+Aronson for the same reasons. *Supra* §VII.E; Fayed, ¶¶315-316.

#### **J. Claims 8-9**

Claims 8-9 recite limitations substantively identical to claims 3-4, respectively, and are met by Tang+TI-Retimer+Aronson for the same reasons. *Supra* §§VII.F-VII.G; Fayed, ¶¶317-318.

#### **K. Claims 11-14**

Independent claim 11 and dependent claims 12-14 recite a “cable manufacturing method” for making a cable as recited in the preceding claims. Fayed, ¶319.

## 1. Claim 11

**Limitation [11.A]** recites connecting first and second ends of conductor pairs to first and second transceivers to transmit signals therebetween. This is met by Tang+TI-Retimer+Aronson's *conductor pairs* ("twinaxial copper cable," Tang, [0015]) connected between SFP+ ends 22k and 22l and their transceivers (TI-Retimer's retimers implementing Tang's signal drivers 44) that transmit signals between the transceivers as discussed *supra* §§VII.D.1-VII.D.5 ([1.PRE]-[1.C]), VII.H.1-VII.H.2 ([6.PRE], [6C], [6.F]-[6.G], [6.I]). Fayed, ¶320. POSAs understood that manufacturing the Tang+TI-Retimer+Aronson's involves "connecting" the conductors to the transceivers so the transceivers can transmit and receive signals over the conductors. Fayed, ¶321; EX1010, Figs. 4A-4B, 6A-7, [0065], [0073]-[0075] (cable assembly involves connecting transceivers and cable conductors via contact/solder pads); EX1012, [0050], [0057], Figs. 1-3 and 7; EX1013, [0019]-[0021] and Fig. 3 (mounting pads for connecting electrical wires). Alternatively, that would have been the conventional and obvious way to manufacture the Tang+TI-Retimer+Aronson cable with a reasonable expectation of success. Fayed, ¶¶321-322.

**Limitations [11.B]-[11.C]** are met because Tang+TI-Retimer+Aronson's SFP+ ends 22k/22l (see Tang Figure 6) are first and second "Small Form-Factor Pluggable Plus Printed Circuit Board" connectors into which first and second

transceivers (TI-Retimer's retimers) are packaged, and SFP+ ends 22k/221 are configured to couple to input/output signals from/to network interface ports of first and second host devices, respectively. *See supra* §§VII.D.3-VII.D.5 ([1.B.i]-[1.C]); Fayed, ¶¶323-324; EX1027, 7-10 (SFP+ housing “contains” transceiver), EX1012, [0050]-[0051], Figs. 1-3. Alternatively, this would have been the conventional and obvious way to implement the SFP+ modules Tang describes. Fayed, ¶¶324-325.

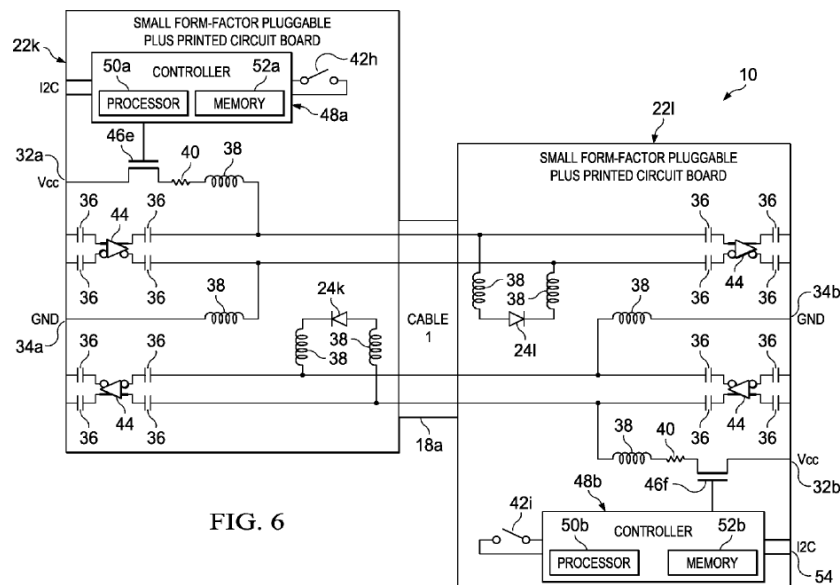


FIG. 6

**Limitation [11.D]** recites that the first and second transceivers are configured to:

- perform CDR to extract and remodulate their respective inbound data stream as signals conveyed across the conductors, which Tang+TI-

Retimer+Aronson meets for the reasons discussed *supra* §VII.D.5

([1.C]);

- perform CDR on the signals received over the conductors to re-modulate the data streams as their respective outbound data streams, which

Tang+TI-Retimer+Aronson meets for the reasons discussed *supra*

§VII.D.6 ([1.D]); and

- employ fixed, cable-independent, equalization parameters for the CDR operations discussed in (1) and (2), which Tang+TI-Retimer+Aronson meets for the reasons discussed *supra* §VII.D.7 ([1.E]). Fayed, ¶¶326-327.

## **2. Claims 12-14**

Claims 12-14 are met by Tang+TI-Retimer+Aronson for the same reasons as claims 2-4, respectively. *Supra* §§VII.E-VII.G; Fayed, ¶¶328-330 (“operation” in claim 13 means the same as “usage” in claim 3).

## **VIII. NO BASIS FOR DISCRETIONARY DENIAL**

With respect to the question of discretionary denial, pursuant to, *e.g.*, the Interim Processes for PTAB Workload Management, dated March 26, 2025, and to the extent necessary, Petitioner will—in separate discretionary denial briefing—fully address the reasons why discretionary denial is unwarranted.

However, as explained above, this petition is substantially the same as Amphenol’s petition in IPR2025-00834, and it is submitted with the intention that Petitioner will seek to join Amphenol’s proceeding as an understudy upon institution. With respect to the timing of a decision, the latest date for a final written decision in IPR2025-00834 is November 12, 2026, and the trial date in the Texas Litigation is January 11, 2027, *see Credo Semiconductor Inc. et al. v. Volex PLC*, No. 2:25-cv-00298, Dkt. 36 (E.D. Tex.). Further, Petitioner is stipulating not to pursue in the Texas Litigation any ground raised or that could have been reasonably raised in this proceeding should the *inter partes* review requested herein be instituted. In sum, these facts—and the arguments set forth in Amphenol’s petition with respect to Section 325(d)—form the high-level basis for why discretionary denial is unwarranted.

## **IX. CONCLUSION**

The Board should institute review and cancel claims 1-14.

Dated: August 7, 2025

/Eric S. Lucas/

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*Lead Counsel for Petitioner*

## APPENDIX A: U.S. PATENT NO. 11,012,252 CLAIM LISTING

| Ref    | Limitation                                                                                                                                                                                                                                                                                                              |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.PRE  | An active Ethernet cable that comprises:                                                                                                                                                                                                                                                                                |
| 1.A    | electrical conductors connected between a first connector and a second connector,                                                                                                                                                                                                                                       |
| 1.B.i  | each of the first and second connectors being adapted to fit into an Ethernet port of a corresponding host device                                                                                                                                                                                                       |
| 1.B.ii | to receive from that host device an electrical input signal conveying an inbound data stream to the cable and to provide to that host device an electrical output signal conveying an outbound data stream from the cable,                                                                                              |
| 1.C    | each of the first and second connectors including a respective transceiver that performs clock and data recovery on the electrical input signal to extract and re-modulate the inbound data stream for transit via the electrical conductors as a respective electrical transit signal conveying a transit data stream, |
| 1.D    | the respective transceiver for each of the first and second connectors performing clock and data recovery on the respective electrical transit signal to extract and re-modulate the transit data stream as the outbound data stream from the cable, and                                                                |
| 1.E    | the respective transceivers each employing fixed, cable-independent, equalization parameters for each of: the remodulation of the transit data stream as the outbound data stream, and the clock and data recovery performed on the electrical input signal.                                                            |
| 2      | The active Ethernet cable of claim 1, wherein the respective transceivers each employ cable-dependent equalization parameters for at least one of: the remodulation of the inbound data stream for transit, and the clock and data recovery performed on the electrical transit signal.                                 |

| <b>Ref</b> | <b>Limitation</b>                                                                                                                                                                                                                                                           |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3          | The active Ethernet cable of claim 2, wherein said cable-dependent equalization parameters adapt during usage of the Ethernet cable.                                                                                                                                        |
| 4          | The active Ethernet cable of claim 2, wherein said cable-dependent equalization parameters are fixed during normal usage of the Ethernet cable, and wherein said cable-dependent equalization parameters are determined during manufacturing-testing of the Ethernet cable. |
| 5          | The active Ethernet cable of claim 4, wherein the inbound data stream and the outbound data stream each have a per-lane symbol rate in excess of 50 GBd.                                                                                                                    |
| 6.PRE      | A communication method that comprises, in a network cable having conductor pairs electrically connecting a first connector to a second connector:                                                                                                                           |
| 6.A        | receiving with the first connector a first electrical input signal conveying a first inbound data stream from a first host device;                                                                                                                                          |
| 6.B        | performing clock and data recovery on the first electrical input signal with a first transceiver in the first connector to extract the first inbound data stream;                                                                                                           |
| 6.C        | re-modulating the first inbound data stream as a first transit data stream conveyed by a first electrical transit signal over a first of the conductor pairs;                                                                                                               |
| 6.D        | receiving with the second connector a second electrical input signal conveying a second inbound data stream from a second host device;                                                                                                                                      |
| 6.E        | performing clock and data recovery on the second electrical input signal with a second transceiver in the second connector to extract the second inbound data stream;                                                                                                       |
| 6.F        | re-modulating the second inbound data stream as a second transit data stream conveyed by a second electrical transit signal over a second of the conductor pairs;                                                                                                           |

| Ref | Limitation                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.G | performing clock and data recovery on the first electrical transit signal with the second transceiver to extract the first transit data stream;                                                                                                                                                                                                                                                                                                                    |
| 6.H | re-modulating the first transit data stream as a second outbound data stream conveyed by a second electrical output signal to the second host device;                                                                                                                                                                                                                                                                                                              |
| 6.I | performing clock and data recovery on the second electrical transit signal with the first transceiver to extract the second transit data stream; and                                                                                                                                                                                                                                                                                                               |
| 6.J | re-modulating the second transit data stream as a first outbound data stream conveyed by a first electrical output signal to the first host device,                                                                                                                                                                                                                                                                                                                |
| 6.K | wherein said re-modulating the first transit data stream, said re-modulating the second transit data stream, said performing clock and data recovery on the first electrical input signal, and said performing clock and data recovery on the second electrical input signal, each employ fixed, cable-independent, equalization [ <i>sic</i> ] parameters.                                                                                                        |
| 7   | The communication method of claim 6, wherein cable-dependent equalization parameters are employed for at least one of: re-modulating the first inbound data stream, re-modulating the second inbound data stream, said performing [ <i>sic</i> ] clock and data recovery on the first electrical transit signal, and said performing clock and data recovery on the second electrical input signal, each employ fixed, cable-independent, equalization parameters. |
| 8   | The communication method of claim 7, wherein said cable-dependent equalization parameters are adaptively updated.                                                                                                                                                                                                                                                                                                                                                  |
| 9   | The communication method of claim 7, wherein said cable-dependent equalization parameters are fixed during normal usage, and wherein the method further comprises: determining said cable-dependent equalization parameters during manufacturer-testing of the network cable.                                                                                                                                                                                      |

| <b>Ref</b> | <b>Limitation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10         | The communication method of claim 9, wherein the first inbound data stream has a per-lane symbol rate in excess of 50 GBd.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 11.PRE     | A cable manufacturing method that comprises:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 11.A       | connecting a first end and a second end of a set of conductor pairs to a first transceiver and a second transceiver, respectively, to transport a first electrical transit signal from the first transceiver to the second transceiver and a second electrical transit signal from the second transceiver to the first transceiver;                                                                                                                                                                                                                                                                                        |
| 11.B       | packaging the first transceiver into a first connector configured to couple a first electrical input signal from a network interface port of a first host device to the first transceiver and a first electrical output signal from the first transceiver to the network interface port of the first host device; and                                                                                                                                                                                                                                                                                                      |
| 11.C       | packaging the second transceiver into a second connector configured to couple a second electrical input signal from a network interface port of a second host device to the second transceiver and a second electrical output signal from the second transceiver to the network interface port of the second host device,                                                                                                                                                                                                                                                                                                  |
| 11.D.i     | the first and second transceivers being configured to perform clock and data recovery on the first and second electrical input signal to extract and re-modulate the first and second inbound data streams respectively as the first and second electrical transit signals conveying first and second transit data streams, configured to perform clock and data recovery on the second and first electrical transit signals to extract and re-modulate the second and first transit data streams as first and second outbound data streams conveyed by the first and second electrical output signals from the cable, and |
| 11.D.ii    | each configured to employ fixed, cable-independent, equalization parameters for clock and data recovery on the respective electrical input signals and for generating the respective electrical output signals.                                                                                                                                                                                                                                                                                                                                                                                                            |

| Ref | Limitation                                                                                                                                                                                                                                                                                                       |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12  | The cable manufacturing method of claim 11, wherein the first and second transceivers are each configured to employ cable-dependent equalization parameters for generating the first and second electrical transit signals and for clock and data recovery on the second and first electrical transit signals.   |
| 13  | The cable manufacturing method of claim 12, wherein the first and second transceivers are each configured to adapt the cable-dependent equalization parameters during operation.                                                                                                                                 |
| 14  | The cable manufacturing method of claim 12, wherein the first and second transceivers are each configured to use preset cable-dependent equalization parameters during operation, and wherein the method further comprises: testing an assembled cable to determine the cable-dependent equalization parameters. |

**CERTIFICATE OF SERVICE UNDER 37 C.F.R. §42.6(e)(4)**

I certify that on August 7, 2025, a copy of the foregoing document, including any exhibits or appendices filed therewith, is being served via *Overnight FedEx* at the following correspondence address of record for the patent:

Ramey LLP  
5020 Montrose Blvd.  
Suite 800  
Houston, TX 77006

Dated: August 7, 2025

/Eric S. Lucas/

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*Lead Counsel for Petitioner*

## **CERTIFICATE OF WORD COUNT**

Pursuant to 37 C.F.R. §42.24, the undersigned certifies that the foregoing Petition for *Inter Partes* Review contains 12,633 words excluding a table of contents, a table of authorities, Mandatory Notices under § 42.8, a certificate of service or word count, or appendix of exhibits or claim listing. Petitioner has relied on the word count feature of the word processing system used to create this paper in making this certification.

Dated: August 7, 2025

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