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Ruggedized push-pull fiber optic connection systems

Abstract

The present disclosure relates to ruggedized push-pull fiber optic connection system. The fiber optic connection system includes a push-pull connector that is adapted to be latched within and sealed with respect to a connector port.

Inventors:	**Lu; Yu (Eden Prairie, MN), Kostecka; Ryan (Waconia, MN), Diepstraten; Patrick Jacques Ann (Beringen, BE)**
Applicant:	**COMMSCOPE TECHNOLOGIES LLC** (Hickory, NC)
Family ID:	**1000008764685**
Assignee:	**CommScope Technologies LLC (Claremont, NC)**
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References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
7467896	12/2007	Melton	385/86	G02B 6/4433
7744288	12/2009	Lu	385/60	G02B 6/3887
8556520	12/2012	Elenbaas et al.	N/A	N/A
9733436	12/2016	Van Baelen	N/A	G02B 6/38875
11215768	12/2021	Rosson	N/A	G02B 6/3873
2009/0148104	12/2008	Lu	385/72	G02B 6/3877
2011/0123157	12/2010	Belsan	439/523	G02B 6/4292
2011/0211792	12/2010	Koreeda	385/60	G02B 6/3879
2011/0229098	12/2010	Abernathy	385/102	G02B 6/4427
2016/0131857	12/2015	Pimentel	385/78	G02B 6/3897
2016/0139346	12/2015	Bund	385/56	G02B 6/44528
2016/0209599	12/2015	Van Baelen	N/A	G02B 6/38875
2017/0153398	12/2016	Compton	N/A	G02B 6/389
2019/0041587	12/2018	Waldron et al.	N/A	N/A
2019/0137697	12/2018	Jensen et al.	N/A	N/A
2019/0384017	12/2018	Lu	N/A	N/A
2020/0064561	12/2019	Alrutz	N/A	G02B 6/3891
2021/0041641	12/2020	Hu	N/A	G02B 6/389
2021/0382248	12/2020	Newbury	N/A	G02B 6/3878
2022/0120989	12/2021	Takeuchi	N/A	G02B 6/44528

FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
108318975	12/2017	CN	N/A
109239857	12/2018	CN	N/A
2018/065293	12/2017	WO	N/A
2019/006195	12/2018	WO	N/A
2019/246241	12/2018	WO	N/A
2020/167779	12/2019	WO	N/A
2020/236512	12/2019	WO	N/A
2021/041305	12/2020	WO	N/A

OTHER PUBLICATIONS

Extended European Search Report for European Patent Application No. 21781363.3 mailed Feb. 21, 2024, 7 pages. cited by applicant
International Search Report and Written Opinion of the International Searching Authority for International Patent Application No. PCT/US2021/025599 mailed Jul. 27, 2021, 11 pages. cited by applicant

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Primary Examiner: Kianni; Kaveh C

Attorney, Agent or Firm: Merchant & Gould P.C.

Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) This application is a National Stage Application of PCT/US2021/025599, filed on Apr. 2, 2021, which claims the benefit of U.S. Patent Application Ser. No. 63/004,400, filed on Apr. 2, 2020, and claims the benefit of U.S. Patent Application Ser. No. 63/089,678, filed on Oct. 9, 2020, the disclosures of which are incorporated herein by reference in their entireties. To the extent appropriate, a claim of priority is made to each of the above disclosed applications.

TECHNICAL FIELD
(1) The present disclosure relates generally to fiber optic connectors. More particularly, the present disclosure relates to fiber optic connectors suitable for outside environmental use.
BACKGROUND
(2) Fiber optic communication systems are becoming prevalent in part because service providers want to deliver high bandwidth communication capabilities (e.g., data and voice) to customers. Fiber optic communication systems employ a network of fiber optic cables to transmit large volumes of data and voice signals over relatively long distances. Optical fiber connectors are an important part of most fiber optic communication systems. Fiber optic connectors allow two optical fibers to be quickly optically connected without requiring a splice. Fiber optic connectors can be used to optically interconnect two lengths of optical fiber. Fiber optic connectors can also be used to interconnect lengths of optical fiber to passive and active equipment.
(3) A typical fiber optic connector includes a ferrule assembly supported at a distal end of a connector housing. A spring is used to bias the ferrule assembly in a distal direction relative to the connector housing. The ferrule functions to support an end portion of at least one optical fiber (in the case of a multi-fiber ferrule, the ends of multiple fibers are supported). The ferrule has a distal end face at which a polished end of the optical fiber is located. When two fiber optic connectors are interconnected, the distal end faces of the ferrules abut one another and the ferrules are forced proximally relative to their respective connector housings against the bias of their respective springs. With the fiber optic connectors connected, their respective optical fibers are coaxially aligned such that the end faces of the optical fibers directly oppose one another. In this way, an optical signal can be transmitted from optical fiber to optical fiber through the aligned end faces of the optical fibers. For many fiber optic connector styles, alignment between two fiber optic connectors is provided through the use of an intermediate fiber optic adapter.
(4) Ruggedized (i.e., hardened) fiber optic connection systems include fiber optic connectors and fiber optic adapters suitable for outside environmental use. These types of systems are typically environmentally sealed and include robust fastening arrangements suitable for withstanding relatively large pull loading and side loading. Example ruggedized fiber optic connection systems

are disclosed by U.S. Pat. Nos. 7,467,896; 7,744,288 and 8,556,520.

SUMMARY

(5) Certain aspects of the present disclosure relate to ruggedized push-pull connection systems. One example push-pull connection system includes connector sealing at a location inwardly positioned within a connector port with respect to a push-pull latching arrangement for latching a fiber optic connector in the connector port. Another example push-pull connection system includes a fiber optic connector with an integral latch for latching the connector within a connector port, and also includes sealing on the inside and the outside of a release sleeve of the fiber optic connector.

(6) A variety of additional inventive aspects will be set forth in the description that follows. The inventive aspects can relate to individual features and to combinations of features. It is to be understood that both the forgoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the broad inventive concepts upon which the embodiments disclosed herein are based.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. **1** depicts an example push-pull fiber optic connection system in accordance with the principles of the present disclosure;

(2) FIG. **2** depicts an example push-pull fiber optic connector of the push-pull fiber optic connection system of FIG. **1**;

(3) FIG. **3** depicts an example fiber optic adapter of the push-pull fiber optic connection system of FIG. **1**;

(4) FIG. **4** depicts an example push-pull latching arrangement of the push-pull fiber optic connection system of FIG. **1**, the latching arrangement being depicted in a latched state;

(5) FIG. **5** depicts the push-pull latching arrangement of FIG. **4** in an unlatched state;

(6) FIG. **6** depicts another example push-pull fiber optic connection system in accordance with the principles of the present disclosure;

(7) FIG. **7** depicts an example fiber optic adapter of the push-pull fiber optic connection system of FIG. **6**;

(8) FIG. **8** depicts an example push-pull fiber optic connector of the push-pull fiber optic connection system of FIG. **6**;

(9) FIG. **9** depicts the push-pull fiber optic connector of FIG. **8** with a dust cap installed over a plug end of the fiber optic connector;

(10) FIG. **10** depicts an example push-pull latching arrangement of the push-pull fiber optic connection system of FIG. **6**, the latching arrangement being depicted in a latched state;

(11) FIG. **11** depicts the push-pull latching arrangement of FIG. **10** in an unlatched state;

(12) FIG. **12** depicts a first type of shroud being mounted over the push-pull connector of FIGS. **6-11**;

(13) FIG. **13** depicts the first type of shroud assembled on the connector of FIGS. **6-11** to form a first type of ruggedized connector;

(14) FIG. **14** is an axial cross-section of the first type of ruggedized connector of FIG. **13**;

(15) FIG. **15** depicts a second type of shroud being mounted over the push-pull connector of FIGS. **6-11**;

(16) FIG. **16** depicts the second type of shroud assembled on the connector of FIGS. **6-11** to form a second type of ruggedized connector;

(17) FIG. **17** is an axial cross-section of the second type of ruggedized connector of FIG. **16**.

DETAILED DESCRIPTION

(18) The expansion of fiber optic networks toward the premises has driven the demand for

enhanced fiber optic connectors suitable for outside environmental uses. For example, in a given fiber optic network, outside fiber optic connectors are used to connect fiber optic cables to structures such as drop terminals (i.e., multi-service terminals), optical network terminals (ONTs), breakout locations on fiber optic cables, fiber distribution hubs, splice closures, pedestals, or other structures. Effective use of fiber optic connectors in outside environments requires the fiber optic connectors to be sealed against the environment and to have robust designs that can withstand relatively large temperature variations, large pulling loads, and significant side loading. It is also desirable for such connectors to be relatively easy to insert and remove from a port in a structure of the type described above. The present disclosure describes various connectors having rugged, robust designs that are environmentally sealed and that are relatively easy to install and uninstall in the field.

(19) FIG. **1** depicts an example push-pull fiber optic connection system **20** in accordance with the principles of the present disclosure. The push-pull fiber optic connection system **20** includes a structure **22** defining a connector port **24**. The push-pull fiber optic connection system **20** also includes a push-pull fiber optic connector **26** adapted to be latched and sealed within the connector port **24** via a push-pull latching arrangement. The latching arrangement is configured to latch the push-pull fiber optic connector **26** within the connector port **24** when the connector **26** is pushed into the connector port **24** and to unlatch the connector **26** with respect to the connector port **24** when the connector **26** is pulled from the connector port **24** (e.g., by grasping and pulling on a release sleeve **50** of the connector **26**). In one example, the push-pull latching arrangement allows for single-handed installation of the connector **26** in the connector port **24** and single-handed disengagement of the connector **26** from the connector port **24**.

(20) Referring to FIGS. **1** and **3**, the structure **22** defining the connector port **24** is depicted as a fiber optic adapter **28**. A fiber optic adapter is a structure for mechanically and optically coupling two fiber optic connectors together. A fiber optic adapter often includes a ferrule alignment sleeve (e.g., see sleeve **30**) for co-axially aligning the ferrules of two fiber optic connectors inserted within opposite ports of the fiber optic adapter. A fiber optic adapter can include an adapter housing that defines the connector ports. The adapter housing can include one or more parts.

(21) In other examples, one or more connector ports of a fiber optic adapter can be defined by structures other than adapter housings. For example, one or both of the connector ports of a fiber optic adapter can be defined directly in the wall of an enclosure. Fiber optic connectors received in fiber optic adapters include single fiber connectors, multi-fiber connectors, ruggedized fiber optic connectors, non-ruggedized connectors (e.g., SC connectors, LC connectors, MPO connectors, etc.), and simplified fiber optic connectors which in certain cases may include only a ferrule.

(22) Referring to FIGS. **1** and **3**, the fiber optic adapter **28** includes an adapter housing **32** having the connector port **24** accessible at one end and another connector port **34** accessible at an opposite end. A ferrule alignment sleeve **30** can be mounted within the housing **32** in axial alignment with the connector ports **24**, **34**. The adapter **28** can be mounted in a sealed manner within an opening **35** defined through a wall **36** of an enclosure **38**. For example, the structure **22** may include a flange to compress a seal (e.g., a radial seal) against an exterior of the wall **36**. A nut or other fastener may be mounted to the structure **22** at the opposite side of the wall **36**. In certain examples, the body of the structure may include a rounded portion defining threads over which the fastener may tighten. As so mounted, the connector port **24** is accessible from outside the enclosure **38** and the connector port **34** is located at an interior of the enclosure **38**.

(23) As depicted at FIG. **1**, a fiber optic connector **40** is secured within the connector port **34** and is positioned such that the fiber optic connector **26** optically couples with the connector **40** when the fiber optic connector **26** is latched within the connector port **24**. In one example, the connector **40** has a ferrule received in one end of the ferrule alignment sleeve **30** and the connector **26** includes a ferrule **42** that is received in an opposite end of the sleeve **30** when the connector **26** is latched in the connector port **24**.

(24) Referring to FIG. **2**, the fiber optic connector **26** includes a connector body **44** defining a plug portion **46** sized and shaped for insertion into the connector port **24**. The fiber optic connector **26** includes a port seal **48** on the connector body **44** for sealing within the connector port **24** (e.g., against a surface defining the connector port **24**) when the fiber optic connector **26** is inserted in the connector port **24**. The fiber optic connector **26** also including a release sleeve **50** that is axially moveable relative to the connector body **44** along an axis **52** of the connector **26**.
(25) The fiber optic connection system **20** includes a latching arrangement for securing the fiber optic connector **26** within the connector port **24**. The latching arrangement is configured to automatically latch the connector body **44** within the connector port **24** when the fiber optic connector **26** is pushed into the connector port **24** in an inward axial direction **54**. The latching arrangement also is configured to unlatch when the release sleeve **50** is pulled in an outward axial direction **56** while the connector body **44** is latched within the connector port **24** to allow the fiber optic connector **26** to be withdrawn in the outward axial direction **56** (FIG. **5**) from the connector port **24**. The port seal **48** is located inwardly within the connector port **24** with respect to the latching arrangement when the connector body **44** is latched within the connector port **24**.
(26) The plug portion **46** of the connector body **44** includes a first region **60** defining a round transverse cross-sectional profile and a second region **62** defining a polygonal (e.g., depicted as square) transverse cross-sectional profile. The adapter **28** preferably includes an inner passage with a cross-sectional profile that complements the outer shape of the plug portion of the connector body **44**. The port seal **48** is depicted as a radial seal than mounts within a circumferential groove **64** defined at the first region **60** of the plug portion **46**. The latching arrangement includes latch catches **66** provided at sides of the polygonal transverse cross-section profile of the second region **62**. Preferably, at least 2, 3 or 4 latch catches are provided. Each latch catch **66** includes a retention surface **68** and a ramp surface **70**. The seal **48** is mounted axially between the second region **62** and a plug end **72** of the connector body **44**. The fiber optic connector **26** includes the ferrule **42** which is located at the plug end **72** and can be spring biased relative to the connector body **44** by a spring **74**. The ferrule **42** supports one or more optical fibers **76** corresponding to a fiber optic cable **78** anchored to a cable anchoring end of the connector body **44**. The connector body **44** can be formed by one or more connector body pieces. The cable **78** can be anchored to the connector body **44** by a crimp, adhesive or the like. As depicted, a shape memory sleeve **82** (e.g., a heat shrink sleeve) containing adhesive is used to secure the cable **78** to the connector body **44** and to provide a seal between the cable **78** and the cable anchoring end of the connector body **44**.
(27) The latching arrangement also includes resilient latches **90** that are biased by their own inherent elasticity toward a latching position (see FIG. **4**). The latches are adapted to engage the retention surfaces **68** of the latch catches **66** to latch the connector **26** within the connector port **24** (see FIG. **4**). The latches **90** are provided at the connector port **24**. In one example, the latches **90** are integral with the adapter housing. Each of the latches includes a ramp surface **92** and a retention surface **94**.
(28) The release sleeve **50** is axially moveable relative to the connector body **44**. A range of axial movement of the release sleeve **50** is limited by a stop arrangement including stops **96**, **98** provided on the connector body **44** between which a stop **100** of the release sleeve **50** is captured. The sleeve **50** is axially moveable between an extended position (see FIG. **4**) and a retracted position (see FIG. **5**). The release sleeve **50** includes a ramp surface **102**. The latches **90** have projections **104** that fit in recesses **106** defined by the sleeve **50** when the latches are in the latching position and the release sleeve **50** is in the extend position. The projections **104** can retain the release sleeve **50** in the extended position when the connector **26** is latched within the connector port **24**.
(29) When the connector **26** is pushed into the connector port **24** in the inward axial direction **54**, the ramp surfaces **70** of the latch catches **66** engage the latches **90** to flex the latches outwardly from the latching state of FIG. **4** to the unlatching state of FIG. **5**. Contact between the surface **70** and the latches **90** allows the latch catches **66** to move inwardly past the latches **90**. Once the

retention surfaces **68** of the latch catches **66** move past the retention surfaces **94** of the latches **90**, the latches resiliently return to the latching position of FIG. **4**. In the latching position of FIG. **4**, the retention surfaces **68**, **94** oppose each other such that the connector body **44** is latched within the connector port **24**. Also, the projections **104** fit within the recesses **106** and the ramp surfaces **92**, **102** oppose each other. The sleeve **50** is in the extended position when the connector **26** is latched within the port **24**.

(30) To remove the connector **26** from the port **24**, the release sleeve **50** is pulled in the outward axial direction **56** to move the release sleeve **50** axially relative to the connector body **44** from the extended position to the retracted position. As the release sleeve **50** is pulled from the extended position to the retracted position, the ramp surfaces **102** engage the ramp surfaces **92** to cause the latches **90** to flex from the latching state to the unlatched state. In the unlatched state, the stop surface **94**, **68** do not oppose or interfere with one another such that the connector **26** can be withdrawn without interference from the latches **90**. Once the connector **26** is withdrawn, the latches **90** resiliently return to the latching state.

(31) FIGS. **6-11** depict another push-pull fiber optic connection system **120** in accordance with the principles of the present disclosure. The system includes structure **122** (e.g., an adapter, see FIGS. **6** and **7**) defining a connector port **124**. The system **120** also includes a fiber optic connector **126** (see FIGS. **6** and **8**) including a connector body **144** defining a plug portion **146** sized and shaped for insertion into the connector port **124**. The fiber optic connector **126** also including a release sleeve **150** that is axially moveable relative to the connector body **144**. The plug portion **146** can be temporarily protected by a dust cap **147** prior to insertion in the connector port **124** (see FIG. **9**). Similar to the previous example, the structure **122** can be secured within an opening defined by a wall of an enclosure and can be sealed with respect to the enclosure at an outer surface of the enclosure by an o-ring or other type of seal (e.g., a seal can be compressed between the outer surface of the enclosure and an outer flange of the structure **122**).

(32) A latching arrangement **149** is provided for securing the fiber optic connector **126** in the connector port **124**. The latching arrangement **149** is configured to automatically latch the connector body **144** within the connector port **124** when the fiber optic connector **126** is pushed into the connector port **124** in an inward axial direction **125** (FIG. **10**). FIG. **10** shows the latching arrangement **149** in the latching/latched state. The latching arrangement **149** is configured to unlatch when the release sleeve **150** is pulled in an outward axial direction **127** (FIG. **11**) while the connector body **144** is latched within the connector port **124** to allow the fiber optic connector **126** to be withdrawn in the outward axial direction **127** from the connector port **124**.

(33) The release sleeve **150** is axially moveable relative to the connector body **144** between an extended position (see FIG. **10**) and a retracted position (see FIG. **11**). A stop arrangement can be used to limit a range of axial travel of the release sleeve **150**. The latching arrangement **149** includes resilient latches **190** integrated with the connector body **144** and latch catches **166** provided at the connector port **124**. It will be appreciated that similar latch catches **166** can be provided in the dust cap **147** for securing the fiber optic connector **126** to the dust cap **147** by a push-pull connection. The latches **190** engage the latch catches **166** to retain the connector body **144** in the connector port **124**. The latch catches **166** are defined by openings **167** through the surface defining the connector port **124**, and include retention surfaces **168**. The latches **190** include retention surfaces **194** that oppose the retention surfaces **168** when the connector body **144** is latched in the connector port **124**. The release sleeve **150** defines openings **161** through which the retention surfaces **194** extend when the connector body **144** is latched in the connector port **124**. Release surfaces **196** are provided on the release sleeve **150** at the openings **161**. The release surfaces **196** oppose ramp surfaces **197** of the latches **190** when the connector body **144** is latched in the connector port **124**. The release sleeve **150** is in the extend position when the connector **126** is latched within the connector port **124**.

(34) A first seal **200** is provided for sealing between the connector body **144** and the release sleeve

150. A second seal **202** is provided for sealing between the structure defining the connector port **124** and the release sleeve **150** when the fiber optic connector **126** is latched within the connector port **124**. The second seal **202** seals against the structure defining the connector port **124** at a position located outside the latching arrangement **149** when the connector body **144** is latched within the connector port **124**. In another example, the seal **202** can be positioned on the connector body **144** inward of the latches **190** so as to be capable of sealing with respect to the connector port **124** at a location inward with respect to the latching arrangement **149**.

(35) When the connector **126** is pushed into the connector port **124** in the inward axial direction **125**, the ramp surfaces **197** of the latches **190** engage surfaces **191** in the port **124** to cause the latches **190** to flex inwardly from the latching state of FIG. **10** to the unlatching/unlatched state of FIG. **11**. This allows the retention surfaces **194** to move inwardly past the retention surface **168**. Once the retention surfaces **194** of the latches move past the retention surfaces **168** of the catches **166**, the latches resiliently return to the latching position of FIG. **10**. In the latching position of FIG. **10**, the retention surfaces **168**, **194** oppose each other such that the connector body **144** is latched within the connector port **124**. Also, retention surfaces **194** extend through the openings **161** of the release sleeve **150** and the release surfaces **196** oppose the ramp surfaces **197**. The sleeve **150** is in the extended position when the connector **126** is latched within the port **124**.

(36) To remove the connector **126** from the port **124**, the release sleeve **150** is pulled in the outward axial direction **127** to move the release sleeve **150** axially relative to the connector body **144** from the extended position to the retracted position. As the release sleeve **150** is pulled from the extended position to the retracted position, the release surfaces **196** engage the ramp surfaces **197** to cause the latches **190** to flex from the latching state (FIG. **10**) to the unlatched state (FIG. **11**). In the unlatched state, the stop surface **194**, **168** do not oppose or interfere with one another such that the connector **126** can be withdrawn without interference between the latches **190** and the retaining surfaces **168**. Once the connector **126** is withdrawn, the latches **190** resiliently return to the latching state.

(37) Referring now to FIGS. **12-17**, a shroud assembly **210**, **230** can be mounted over any of the connectors disclosed herein to enable the connector to mate with a different type of adapter. In FIGS. **12-17**, example shroud assemblies are shown with the connector **126** of FIGS. **6-11**. In other examples, however, the shroud assemblies can be mounted over the connector **26** or another push-pull fiber optic connector. For example, the shroud assemblies **210**, **230** may adapt the connector **126** to form a ruggedized connection with the different type of adapter. As the term is used herein, a "ruggedized connection" refers to an environmentally sealed connection between the connector **126** and the adapter. A "ruggedized connection" also indicates a robust mechanical fastening, such as a twist-to-lock connection (e.g., a bayonet or threaded type connection) or a robust snap-fit connection, between the connector **126** and the adapter.

(38) The shroud assembly **210**, **230** defines a through-passage extending between opposite first and second open ends of the shroud **210**, **230**. The through-passage is sized to receive at least the plug portion **146** of the connector body **144**. In particular, the plug portion **146** is inserted into the through-passage through the open first end **212**, **232**. The plug portion **146** extends through the shroud **210**, **230** so that a ferrule tip of the plug portion **146** is accessible at the second end **214**, **234** of the through-passage. The shroud assembly **210**, **230** includes a mechanical securement structure **224**, **244** to hold the shroud assembly **210**, **230** to an adapter. In one example, the mechanical securement structure **224**, **244** includes a twist to lock connection such as a bayonet or threaded type connection.

(39) The shroud assembly **210**, **230** also is configured to engage the connector **126** to retain at least a portion of the shroud assembly **210**, **230** on the connector **126** in a fixed axial position. In certain examples, the latches **190** of the connector **126** are disposed within the through-passage when the shroud assembly **210**, **230** is mounted over the connector **126** (e.g., see FIGS. **14** and **17**). The latches **190** snap-fit over catch surfaces **220**, **240** at a rearward end of the shroud assembly **210**, **230**

to axially retain the shroud assembly **210**, **230** on the connector **126**.
(40) In certain implementations, the second seal **202** of the connector **126** also is disposed within the through-passage of the shroud **210**, **230**. The shroud assembly **210**, **230** defines a seal engagement surface **222**, **242** that engages the second seal **202** when the shroud assembly **210**, **230** is mounted over the connector **126**.
(41) FIGS. **12-14** illustrate a first type of shroud assembly **210** being utilized in connection with the connector **126**. The first shroud assembly **210** has an outer housing **216** and an inner housing **218** that are axially and rotationally movable relative to each other. The outer housing **216** carries the securement structure **224**. In the example shown in FIG. **14**, the mechanical securement structure **224** of the first shroud **210** includes a bayonet pin configured to slide along a retention slot defined by the corresponding adapter. The inner housing **218** of the first shroud **210** defines the catch surfaces **220** for the connector latch **190**. The inner housing **218** also defines the seal engagement surface **222**. In certain implementations, the inner housing **218** can include notches, extensions, or the like for providing keying and/or intermateability with respect to the corresponding adapter. For example, such notches and/or extensions can be disposed at the second end **214** of the shroud **210**.
(42) FIGS. **15-17** illustrate a second type of shroud assembly **230** being utilized in connection with the connector **126**. The second shroud assembly **230** has an outer housing **236** and an inner housing **238** (e.g., see FIG. **16**). The outer housing **236** of the second shroud assembly **230** includes a fastener that is axially and rotatably movable relative to the inner housing **238**. The inner housing **238** of the second shroud **230** defines the catch surfaces **240** for the connector latch **190**. The inner housing **238** also defines the seal engagement surface **242**.
(43) The outer housing **236** carries the securement structure **244**. In the example shown in FIG. **16**, the mechanical securement structure **244** of the second shroud **230** includes outwardly facing threads configured to mate with inwardly facing threads of the corresponding adapter. In other examples, the threads **244** of the second shroud **230** can be inwardly facing instead. In certain examples, the inner housing **238** carries an outer seal **246** that seals to the adapter. In certain examples, the inner housing **238** defines extensions **248** to protect the end face of the connector **126**.
(44) Having described the preferred aspects and implementations of the present disclosure, modifications and equivalents of the disclosed concepts may readily occur to one skilled in the art. However, it is intended that such modifications and equivalents be included within the scope of the claims which are appended hereto.

Claims

1. A push-pull connector system comprising: structure defining a connector port; a fiber optic connector including a connector body defining a plug portion sized and shaped for insertion into the connector port, the fiber optic connector also including a release sleeve that is axially moveable relative to the connector body; and a latching arrangement for securing the fiber optic connector within the connector port, the latching arrangement being configured to automatically latch the connector body within the connector port when the fiber optic connector is pushed into the connector port in an inward axial direction, the latching arrangement being configured to unlatch when the release sleeve is pulled in an outward axial direction while the connector body is latched within the connector port to allow the fiber optic connector to be withdrawn in the outward axial direction from the connector port, the latching arrangement including a latch integrated with the connector body and a latch catch provided at the connector port; and a first seal for providing sealing between the connector body and the release sleeve and a second seal for providing sealing between the structure defining the connector port and the release sleeve when the fiber optic connector is latched within the connector port.
2. The push-pull connector system of claim 1, wherein the second seal seals against the structure

defining the connector port at a position located outside the latching arrangement when the connector body is latched within the connector port.
3. The push-pull connector system of claim 1, wherein the structure includes an optical adapter.
4. The push-pull connector system of claim 1, further comprising a shroud for adapting the fiber optic connector to secure to a ruggedized optical adapter.
5. The push-pull connector system of claim 4, wherein the shroud has a bayonet type securement arrangement to secure the shroud to the ruggedized optical adapter.
6. The push-pull connector system of claim 4, wherein the shroud has threads to secure the shroud to the ruggedized optical adapter.
7. The push-pull connector system of claim 4, wherein the shroud includes an outer housing and an inner housing that are axially and rotationally movable relative to each other, the outer housing carrying a securement structure to secure the shroud to the ruggedized optical adapter.
8. The push-pull connector system of claim 7, wherein the securement structure includes a bayonet pin configured to slide along a retention slot defined by the ruggedized optical adapter.
9. The push-pull connector system of claim 7, wherein the inner housing defines the latch catch.
10. The push-pull connector system of claim 4, wherein the shroud includes an outer housing and an inner housing, the outer housing including a fastener that is axially and rotatably movable relative to the inner housing.
11. The push-pull connector system of claim 10, wherein the inner housing defines the latch catch and a seal engagement surface.
12. The push-pull connector system of claim 10, wherein the inner housing carries an outer seal that seals to the connector port.
13. The push-pull connector system of claim 1, wherein at least one of the release sleeve and the latching arrangement includes a ramp surface for moving the latching arrangement from the latching position to the unlatched position when the release sleeve is pulled in the outward axial direction while the connector body is latched in the connector port.
14. A push-pull connector system comprising: structure defining a connector port; a fiber optic connector including a connector body defining a plug portion sized and shaped for insertion into the connector port, the fiber optic connector also including a release sleeve that is axially moveable relative to the connector body; a latching arrangement for securing the fiber optic connector within the connector port, the latching arrangement being configured to automatically latch the connector body within the connector port when the fiber optic connector is pushed into the connector port in an inward axial direction, the latching arrangement being configured to unlatch when the release sleeve is pulled in an outward axial direction while the connector body is latched within the connector port to allow the fiber optic connector to be withdrawn in the outward axial direction from the connector port, the latching arrangement including a latch integrated with the connector body and a latch catch provided at the connector port; a first seal for providing sealing between the connector body and the release sleeve and a second seal for providing sealing between the structure defining the connector port and the release sleeve when the fiber optic connector is latched within the connector port; and a shroud for adapting the fiber optic connector to secure to a ruggedized optical adapter.
15. The push-pull connector system of claim 14, wherein the second seal seals against the structure defining the connector port at a position located outside the latching arrangement when the connector body is latched within the connector port.
16. The push-pull connector system of claim 14, wherein the structure includes an optical adapter.
17. The push-pull connector system of claim 14, wherein the shroud has a bayonet type securement arrangement to secure the shroud to the ruggedized optical adapter.
18. The push-pull connector system of claim 14, wherein the shroud has threads to secure the shroud to the ruggedized optical adapter.
19. The push-pull connector system of claim 14, wherein the shroud includes an outer housing and

an inner housing that are axially and rotationally movable relative to each other, the outer housing carrying a securement structure to secure the shroud to the ruggedized optical adapter.

20. The push-pull connector system of claim 19, wherein the securement structure includes a bayonet pin configured to slide along a retention slot defined by the ruggedized optical adapter.

21. The push-pull connector system of claim 19, wherein the inner housing defines the latch catch.

22. The push-pull connector system of claim 14, wherein the shroud includes an outer housing and an inner housing, the outer housing including a fastener that is axially and rotatably movable relative to the inner housing.

23. The push-pull connector system of claim 22, wherein the inner housing defines the latch catch and a seal engagement surface.

24. The push-pull connector system of claim 22, wherein the inner housing carries an outer seal that seals to the connector port.