

Description

Technical Field

This invention relates to an optical fiber splicing device.

Background of the Invention

Optical fiber connectors and splicing devices are an important part of substantially any optical fiber communication systems. For instance, connectors or splicing devices may be used to join segments of fiber into longer lengths or to connect fiber to active devices such as radiation sources, detectors, or repeaters, or to passive devices such as switches or attenuators. Considering that a core of multimode optical fiber is 50 microns in diameter and that of single mode fiber is 8 microns, the connection or splicing is no small task. An optical fiber connector is disclosed in U. S. Patents 4,850,670 and 4,545,644.

The making of single-mode connections in the prior art typically has involved the active alignment of the fiber ends. Prior art methods comprise translating one fiber end relative to the other, typically by means of a precision stage, until maximum energy coupling across a gap therebetween is observed, for example, by means of a remote detector. As will be appreciated, such a procedure is both difficult to carry out in the field and requires highly skilled personnel.

Drawn glass or other ferrule-type fiber connectors and splicing devices generally offer low cost, simplicity, relatively low-loss single-mode connections, environmental stability, and versatility. Because of these advantages, a connector or splicing device that includes a capillary tube drawn from glass or other material would be of considerable importance.

Notwithstanding the commercial availability of splicing devices, the search for a reliable optical fiber splicing device has continued. Sought after is a splicing device that is relatively simply and easily installed in the field, that is rugged, and that has acceptable temperature cyclability. Also, the sought-after splicing device should be one which provides a connection having a loss which is sufficiently low to obviate the need for expensive precision alignment apparatus. Further, it has long been desired to provide a relatively low cost optical fiber splicing device for general usage. Also, the splices which are achieved with many of the prior art devices require the use of adhesive materials or gels which require curing. It would be most desirable to have available a mechanical splice which does not require the use of materials to be cured.

A more recently developed optical fiber splicing device is one which is described as cleave, sleeve

and leave. In it, end portions of optical fibers are caused to be disposed in a capillary tube with center portions exposed. A flexible metallic member in the center of the capillary tube is folded over the spliced end portions to retain the spliced portions in engagement with each other.

There is another feature which is desired in the sought-after splicing device. Considering the dimensions of the transmission media to be spliced, it would be highly desirable to be able to inspect the spliced ends of the optical fibers without the need for expensive apparatus. A splicing device which includes this feature does not appear to be available in the prior art.

What is desired and seemingly what is not available in the prior art is a relatively low cost, mechanical optical fiber splicing device which does not involve curable materials and which allows inspection of the spliced ends of the optical fibers. The sought-after splicing device should be one which is simplistic in structure yet one which provides a reliable relatively low loss and relatively low return loss splice connection.

According to the present invention there is provided a device as defined in claim 1.

The foregoing problems of the prior art have been overcome with an optical fiber splicing device of this invention. The optical fiber splicing device of this invention comprises a tubular member hereinafter referred to as a capillary tube having a longitudinal centerline axis and a passageway formed therethrough for holding end portions of optical fibers to be spliced. The capillary tube has a slot formed therein with a groove portion of the passageway extending across a planar surface formed by the slot. The passageway is formed parallel to the longitudinal centerline axis. In a preferred embodiment, the passageway is formed eccentrically with respect to the longitudinal centerline axis and the slot is formed between the axis of the passageway and the most adjacent outer peripheral surface of the capillary tube.

Also, the splicing device includes energy storage means adapted to be mounted in an open position with respect to the capillary tube. In such position, the clamping means is spaced from the end portions of the optical fibers which are disposed in the groove which extends across the planar surface formed by the slot. The clamping means is movable to a closed, second position in which it is secured in clamping engagement with the end portions of the fibers disposed in the groove which opens to the planar surface formed by the slot.

Further, the optical fiber splicing device includes a housing for holding the capillary tube. The housing is provided with portions which cooperate with portions of the clamping means to hold the energy storage means in clamping engagement with the end portions of the optical fibers.

In a preferred embodiment, the clamping means comprises a spring clamp having side portions which engage with side portions of the housing. An underside of the spring clamp is provided with a compliant material. When the spring clamp is moved to the closed position, the compliant material becomes disposed in compressive engagement with the exposed end portions of the optical fibers. The spring clamp is effective to prevent damage to the exposed end portions of the optical fibers.

Advantageously, the housing is made of a transparent material and an underside of the housing is arcuately shaped. The interface between the held capillary tube and the transparent housing is index-matched to facilitate the creation of a lensing effect from the cooperation of the arcuately shaped housing portion and the capillary tube which in a preferred embodiment is cylindrically shaped. As a result of this configuration, a craftsman viewing the underside of the housing may inspect the splice connection.

Brief Description of the Drawing

FIG. 1 is an exploded perspective view of an optical fiber splicing device of this invention which includes a housing, a slotted capillary tube and a spring clamp;

FIG. 2 is an end view of the spring clamp of FIG. 1;

FIG. 3 is a perspective view of the optical fiber splicing device of FIG. 1 as assembled with the spring clamp thereof in an open position;

FIG. 4 is an elevational view partially in section of the assembly of FIG. 3;

FIG. 5 is an end view in section of the optical fiber splicing device of FIG. 3 with the spring clamp thereof in an open position;

FIG. 6 is a perspective view of the optical fiber splicing device of FIG. 1 as assembled with the spring clamp thereof in a closed position; and

FIG. 7 is an end view in section of the optical fiber splicing device of FIG. 6 with the spring clamp thereof in a closed position.

Detailed Description

Referring now to FIG. 1 there is shown an optical fiber splicing device which is designated generally by the numeral 20. The optical fiber splicing device includes a housing designated generally by the numeral 22, a capillary tube member designated generally by the numeral 24 and a clamping member designated generally by the numeral 26 (see also FIGS. 2 and 3). The optical fiber splicing device 20 is adapted to provide a splice connection between two optical fibers 30-30 (see FIG. 4).

End portions 32-32 of the two optical fibers 30-30 are caused to be held in butted relationship to pro-

vide a splice connection therebetween. As is well known, each of the optical fibers 30-30 includes a glass core and a glass cladding. In order to protect the optical fiber, one or more coatings typically enclose the cladding.

Referring again to FIG. 1, it can be seen that the housing 22 is elongated and includes opposed end portions 42-42 with a center portion 44 therebetween. The housing 22 is made of a transparent plastic material which in a preferred embodiment is polysulfone. Each of the end portions 42-42 includes two sides 46-46, an end 47, a top 48 and a bottom portion 49. As can be seen best in FIG. 1, the top 48 extends along only a portion of the sides 46-46 after which the sides are tapered (see also FIGS. 3-4) from the top to the center portion 44. Each end 47 includes an opening 51 which is adapted to receive the end portion of an optical fiber to be spliced. It is not necessary that the bottom 49 extend to the end 47 and instead may be spaced therefrom as shown in FIG. 4.

The center portion 44 of the housing 22 extends between ends 53-53 of the tapered portions of the sides 46-46. The center portion 44 includes two sides 54-54 and a bottom 56. The sides 54-54 of the center portion 44 are integral with the sides 46-46 of the two end portions 42-42. As is seen in FIG. 1, the center portion 44 is formed with a wedge-shaped free longitudinal edge portion 57 having an outer inclined surface 58 (see also FIG. 5). The outer inclined edge surface 58 is connected to a surface 59 which appears vertical in FIG. 5. The surface 59 is undercut along a portion 61 to provide a latching portion which connects to a longitudinally extending surface 62 which also appears oriented vertically in FIG. 5. The surface 62 joins to a camming surface 63 which at its outermost point is connected to another vertical surface 64. The vertical surface 64 falls off at another undercut, latching portion 66. The bottom 56 of at least the center portion 44 is provided with a radiused portion 67 (see FIG. 5).

Viewing again FIG. 4, it can be seen that the opening 51 in each end 47 of the housing 22 communicates with a channel 71 which tapers inwardly. The channel 71 extends through a transition portion 73 to an outer surface of an end wall 74. The channel 71 is interrupted by a cross-channel 76 which may be used to introduce an index-matching material into the channel 71.

As can be seen in FIG. 1, the sides, bottoms and tops of the housing 22 and the end walls 74-74 define a cavity 78. The cavity extends from a juncture between the top 48 at one end and the adjacent tapered side portions to the juncture of the top 48 at the opposite end to the tapered side portions (see also FIG. 4).

Adapted to be received in the cavity 78 formed within the housing 22 is the capillary tube member 24 (see FIGS. 1, 3, 4 and 5). Preferably the capillary

member 24 is made of transparent glass and has a passageway 81 extending therethrough. The passageway 81 is adapted to receive end portions of two optical fibers to be spliced. Further, each outer end portion of the passageway 81 of the glass capillary tube member 24 is provided with a flared portion 83 to facilitate the insertion of an end portion of an optical fiber 30 into the passageway. It should be observed that the longitudinally extending passageway 81 is formed eccentrically with respect to a longitudinal centerline axis 85 of the capillary tube member.

The capillary tube member 24 is provided with a slot 86 which is disposed centrally. In keeping with this structure, the capillary tube member 24 often is referred to as a slotted capillary tube. The slot 86 extends inwardly to an extent such that a groove 88 comprising about half the cross section of the passageway 81 is formed in a planar chordal portion 87 of the slotted portion (see FIGS. 1 and 5). As can be seen in FIG. 5, the slot 86 is formed to remove a portion of the capillary tube member 24 through which the longitudinal centerline axis 85 does not extend. In this way, that portion of the capillary tube member 24 which remains after the slot has been cut has enhanced strength over that which would be provided if the groove and chordal portion were along the centerline axis.

Also, as can be seen best in FIG. 5, the capillary tube member 24 is formed with a flat 89 diametrically opposite to the slotted portion. When the slotted capillary member 24 is disposed within the cavity 78 of the housing 22, the flat 89 is adapted to seat in engagement with an inner surface 95 of the bottom portions 49 and 56 of the end portions 42-42 and of the center portion 44, respectively (see FIG. 5). Also, it should be observed from FIG. 5, that when the slotted capillary tube member 24 is seated within the housing 22, the planar portion 87 is spaced slightly above the wedge shaped portions 57-57 of the center portion 44. Further, the length of the slotted portion 86 of the capillary member 24 is coextensive with the length of the center portion 44 of the housing 22.

Disposed along the glass-plastic interface between the outer peripheral surface of the capillary member 24 and arcuately shaped inner walls 90-90 of the side members of the end portions 42-42 and of the center portion of the housing 22 is a grease-like index matching material. The radius of the portion 87 which is made of polysulfone, for example, is such that the bottom of at least the center portion cooperates with the partially circular cross-section capillary tube member 24 to provide a lensing effect. As such, the end portions 32-32 of the optical fibers 30-30 in the vicinity of the splice are magnified. This allows a craftsman to be able to view the interior of the housing 22 and more particularly the area of the splice connection. But for the index-matching materials, air would occupy the interface and interfere with

the visual inspection of the splice.

The clamping member 26 (see FIGS. 1 and 2) is adapted to span across the slotted portion 86 of the capillary tube member 24 to maintain the exposed end portions of the optical fibers 30-30 in butted alignment with each other. In a preferred embodiment, the clamping member 26 is an energy storage device such as a spring member which is made of a metallic material, such as, for example, spring steel. The clamping member 26 comprises a clamping portion 91 having a depressed center portion 92 and two lateral portions 93-93. From the end of each lateral portion 93 extends inwardly a toothed portion 94. Also, an underside center portion of the clamping portion 91 is provided with a strip 96 of a compliant material.

As shipped from a manufacturer, the splicing device 20 appears as is shown in FIGS. 3, 4 and 5. The slotted capillary member 24 is disposed within the cavity 78 in the housing 22. With the flat 89 of the capillary member 24 engaging the bottom 95 of the housing 22, the flared entrance 83 at each end of the capillary member becomes aligned with the exit of the adjacent transition portion 73 of the channel 71. Also, as can be seen, the clamping member 26 is mounted on the housing in an armed, first position with the toothed portions 94-94 in engagement with the undercut portions 61-61 (see also FIG. 5) of the center portion 44 of the housing 22. In this position, the clamping member 26 is in an armed position with the clamping portion 91 spanning across the planar portion 87 and spaced therefrom.

In use of the optical fiber splicing device 20, the end portion of each optical fiber 30 to be spliced is stripped of its coating or coatings. Typically, this results in exposed end portions 32-32 of the optical fibers 30-30 each having an outer diameter of about 125 microns. Then a craftsman cleaves the end of the end portion 32 of each optical fiber 30.

Afterwards, the craftsman inserts the stripped end portion 32 of one of the optical fibers 30 into one of the openings 51-51 and the other end portion into the other opposite opening. The craftsman applies forces to each optical fiber end portion 32 to move it through its associated channel 71 and into an aligned flared opening 83 in the capillary member 24. The stripping is accomplished such that when the end of the stripped portion of the fiber 30 is aligned with the inner end of the flared entrance portion 83, the cleaved end of the fiber is substantially at the transverse center of the capillary member 24. Accordingly, when both optical fibers 30-30 have been inserted, the cleaved ends should abut each other generally at the center of the capillary member 24.

The insertion of the end portions 32-32 of the optical fibers 30-30 is carried out in the presence of an index matching grease-like material which is available commercially. The index matching material is

preinserted into the passageway 81 in the capillary tube member 24. Also, as will be recalled, it may be preinserted, for example, into the cross-channels 76-76. The insertion of the end portions drags and pushes some of the grease-like material through a circular portion of the passageway 81 toward the semicircular, grooved portion 88 of the passageway in the center, slotted portion 86 of the capillary tube member 24.

With the fiber end portions 32-32 inserted to abut the cleaved fiber ends and the clamping member 26 in its armed position, the splicing device 20 is ready for the final step. The craftsman causes the clamping member 26 to be moved to a clamping, second position as shown in FIGS. 6 and 7. As the craftsman applies downwardly directed forces to the clamping member 26 (as viewed in FIG. 5), the toothed portions 94-94 ride downwardly along the vertical surfaces 62-62 and then are cammed outwardly along the camming portions 63-63 until they engage the vertical surfaces 64-64. Further movement causes the toothed portions 94-94 to clear the lower ends of the surfaces 64-64 and snap-lock under the latching surfaces 66-66. This secures the clamping member 26 in engagement with the housing 22.

When the clamping member 26 is secured to the housing 22, as shown in FIGS. 6 and 7, the strip 96 of compliant material secured to an underside of the depressed center portion 92 of the clamping portion 91 engages the stripped fiber end portions in the semicircular portion 88 of the passageway 81 which opens to the planar surface 87. This causes the stripped, butted end portions of the optical fibers to be held in alignment as can be viewed through the radiused lens portion 67 of the housing 22 from its underside.

It is to be understood that the above-described arrangements are simply illustrative of the invention. Other arrangements may be devised by those skilled in the art which will embody the principles of the invention and fall within scope thereof.

Claims

1. An optical fiber splicing device (20), comprising: a capillary tube member (24) which is substantially cylindrical and thereby establishes a longitudinal centerline axis (85) said tube member having a passageway (81) passing through end portions (42-42) thereof for holding portions of optical fibers (30-30) to be spliced, said passageway (81) being formed parallel to said longitudinal centerline axis (85), said capillary tube member (24) having a slot which extends transversely to the tube and is formed between the end portions thereof with a groove portion (88) collinear with said passageway and communicat-

ing with said passageway in said end portions of said capillary tube member said groove portion being formed in one of the surfaces which define said slot and being adapted to hold end portions of optical fibers to be spliced; and a housing (22) having a cavity (78) in which is disposed said capillary tube member characterized by: said housing including means engageable with clamping means (26) to hold said clamping means in an open position with respect to said capillary tube member (24) in which position said clamping means (26) is spaced from the end portions of the fibers when disposed in said groove (88) said clamping means being movable on the housing to a second position in which it is secured in clamping engagement with the end portions of the fibers disposed in said groove; and further characterized by said housing (22) including a center portion (44) having a rounded portion (67) which is positioned on the opposite side of the capillary tube from said groove, which is aligned with the ends of the fiber end portions and which is arranged to cooperate with the configuration of said capillary tube member to function like a lens to facilitate visual inspection of the vicinity of the splice via the rounded portion (67) of the housing (22) and the capillary tube (24).

2. The optical fiber splicing device of claim 1, wherein said passageway is formed eccentrically with respect to said longitudinal centerline axis and wherein said slot is formed such that in a transverse cross section of said capillary tube member which is normal to the longitudinal centerline axis, the portion of said capillary tube member remaining after said slot has been formed is more than half the area of the cross section and is defined by a portion of a circle which is longer than half the circumference of the transverse cross section and a chord which is less in length than an outer diameter of said capillary tube member.
3. The optical fiber splicing device of claim 1, wherein said clamping means comprises a spring clamp having an inverted U-shape and comprising two lateral portions joined by a clamping portion and wherein said clamping portion includes a depressed central portion which when said spring clamp is disposed in said second position is adapted to apply compressive forces to the exposed end portions of the optical fibers in the slotted portion of said capillary tube member.
4. The optical fiber splicing device of claim 3, wherein each of said lateral portions of said spring clamp includes an inwardly directed toothed portion adapted to engage a first latching por-



preinserted into the passageway 81 in the capillary tube member 24. Also, as will be recalled, it may be preinserted, for example, into the cross-channels 76-76. The insertion of the end portions drags and pushes some of the grease-like material through a circular portion of the passageway 81 toward the semi-circular, grooved portion 88 of the passageway in the center, slotted portion 86 of the capillary tube member 24.

With the fiber end portions 32-32 inserted to abut the cleaved fiber ends and the clamping member 26 in its armed position, the splicing device 20 is ready for the final step. The craftsman causes the clamping member 26 to be moved to a clamping, second position as shown in FIGS. 6 and 7. As the craftsman applies downwardly directed forces to the clamping member 26 (as viewed in FIG. 5), the toothed portions 94-94 ride downwardly along the vertical surfaces 62-62 and then are cammed outwardly along the camming portions 63-63 until they engage the vertical surfaces 64-64. Further movement causes the toothed portions 94-94 to clear the lower ends of the surfaces 64-64 and snap-lock under the latching surfaces 66-66. This secures the clamping member 26 in engagement with the housing 22.

When the clamping member 26 is secured to the housing 22, as shown in FIGS. 6 and 7, the strip 96 of compliant material secured to an underside of the depressed center portion 92 of the clamping portion 91 engages the stripped fiber end portions in the semicircular portion 88 of the passageway 81 which opens to the planar surface 87. This causes the stripped, butted end portions of the optical fibers to be held in alignment as can be viewed through the radiused lens portion 67 of the housing 22 from its underside.

It is to be understood that the above-described arrangements are simply illustrative of the invention. Other arrangements may be devised by those skilled in the art which will embody the principles of the invention and fall within scope thereof.

Claims

1. An optical fiber splicing device (20), comprising: a capillary tube member (24) which is substantially cylindrical and thereby establishes a longitudinal centerline axis (85) said tube member having a passageway (81) passing through end portions (42-42) thereof for holding portions of optical fibers (30-30) to be spliced, said passageway (81) being formed parallel to said longitudinal centerline axis (85), said capillary tube member (24) having a slot which extends transversely to the tube and is formed between the end portions thereof with a groove portion (88) collinear with said passageway and communicat-

ing with said passageway in said end portions of said capillary tube member said groove portion being formed in one of the surfaces which define said slot and being adapted to hold end portions of optical fibers to be spliced; and a housing (22) having a cavity (78) in which is disposed said capillary tube member characterized by: said housing including means engageable with clamping means (26) to hold said clamping means in an open position with respect to said capillary tube member (24) in which position said clamping means (26) is spaced from the end portions of the fibers when disposed in said groove (88) said clamping means being movable on the housing to a second position in which it is secured in clamping engagement with the end portions of the fibers disposed in said groove; and further characterized by said housing (22) including a center portion (44) having a rounded portion (67) which is positioned on the opposite side of the capillary tube from said groove, which is aligned with the ends of the fiber end portions and which is arranged to cooperate with the configuration of said capillary tube member to function like a lens to facilitate visual inspection of the vicinity of the splice via the rounded portion (67) of the housing (22) and the capillary tube (24).

2. The optical fiber splicing device of claim 1, wherein said passageway is formed eccentrically with respect to said longitudinal centerline axis and wherein said slot is formed such that in a transverse cross section of said capillary tube member which is normal to the longitudinal centerline axis, the portion of said capillary tube member remaining after said slot has been formed is more than half the area of the cross section and is defined by a portion of a circle which is longer than half the circumference of the transverse cross section and a chord which is less in length than an outer diameter of said capillary tube member.

3. The optical fiber splicing device of claim 1, wherein said clamping means comprises a spring clamp having an inverted U-shape and comprising two lateral portions joined by a clamping portion and wherein said clamping portion includes a depressed central portion which when said spring clamp is disposed in said second position is adapted to apply compressive forces to the exposed end portions of the optical fibers in the slotted portion of said capillary tube member.

4. The optical fiber splicing device of claim 3, wherein each of said lateral portions of said spring clamp includes an inwardly directed toothed portion adapted to engage a first latching por-



tion of said housing to hold said spring clamp secured to said housing during the insertion into said capillary tube member of end portions of optical fibers to be spliced, and wherein said housing also includes camming portions being formed along said center portion thereof and being adapted upon the application of forces to said spring clamp in said first position to cause each said toothed portion to ride along one of said camming portions and be cammed outwardly and toward a second latching portion whereupon said toothed portions snap-lock into latching engagement with said second latching portions to hold said depressed portion in clamping engagement with exposed portions of the optical fibers being spliced.

5. The optical fiber splicing device of claim 4, wherein an underside of the central portion of said spring clamp is provided with a compliant material which engages the exposed portions of the optical fibers in said groove when said spring clamp is in the second position.

6. The optical fiber splicing device of claim 5, wherein said passageway in said capillary tube member is interrupted by said slot such that said slot includes a planar portion with a portion of said passageway extending as said groove along said planar portion to receive the exposed end portions of optical fibers to be spliced.

7. The optical fiber connector of claim 6, wherein opposite end walls of said housing each including a tapered channel which communicates with a flared opening in said end wall of said housing and with the cavity of said housing in which is disposed said capillary tube member.

8. Spliced optical fiber transmission media, which includes a first optical fiber transmission medium (30), and a second optical fiber transmission medium (30) having an end portion which is spliced to an end portion of said first transmission medium, said spliced optical fiber transmission media being characterized by
an optical fiber splicing device (20) in accordance with claim 1.

Revendications

1. Dispositif de raccordement de fibres optiques (20), comprenant :

un élément formant tube capillaire (24) qui est essentiellement cylindrique et établit un axe central longitudinal (85), ledit élément formant tube capillaire comportant un passage (81) qui

traverse ses parties d'extrémité (42-42) pour maintenir des parties de fibres optiques (30-30) à raccorder, ledit passage (81) étant formé parallèlement audit axe central longitudinal (85), ledit élément formant tube capillaire (24) comportant une entaille qui s'étend transversalement par rapport au tube et présente, entre les parties d'extrémité de celui-ci, une partie rainurée (88) collinéaire avec ledit passage et communiquant avec celui-ci dans lesdites parties d'extrémité dudit élément formant tube capillaire, ladite partie rainurée étant formée dans une des surfaces qui définissent l'entaille et étant à même de maintenir des parties d'extrémité de fibres optiques à raccorder; et un étui (22) comportant une cavité (78) dans laquelle est disposé ledit élément formant tube capillaire, caractérisé en ce que ledit étui comprend des moyens pouvant être engagés avec un moyen de serrage (26) pour retenir ledit moyen de serrage, dans une position ouverte par rapport audit élément formant tube capillaire (24), position dans laquelle ledit moyen de serrage (26) est espacé des parties d'extrémité des fibres lorsqu'elles sont disposées dans ladite rainure (88), ledit moyen de serrage étant déplaçable sur l'étui vers une deuxième position dans laquelle il est fixé en contact de serrage avec les parties d'extrémité des fibres disposées dans ladite rainure et caractérisé, en outre, en ce que ledit étui (22) comprend une partie médiane (44) présentant une partie arrondie (67) qui est disposée du côté du tube capillaire opposé à ladite rainure, qui est alignée avec les extrémités des parties d'extrémité des fibres et qui est agencée pour coopérer avec la configuration dudit élément formant tube capillaire pour servir de lentille afin de faciliter l'inspection visuelle des alentours du raccordement par l'intermédiaire de la partie arrondie (67) de l'étui (22) et du tube capillaire (24).

2. Dispositif de raccordement de fibres optiques selon la revendication 1, dans lequel ledit passage est formé excentriquement par rapport audit axe longitudinal central et dans lequel ladite entaille est formée, de telle sorte que dans une section transversale dudit élément formant tube capillaire qui est perpendiculaire à l'axe central longitudinal, la partie dudit élément formant tube capillaire qui subsiste une fois que ladite entaille a été formée soit supérieure à la moitié de l'aire de la section transversale et soit définie par une partie d'un cercle qui dépasse la moitié de la circonférence de la section transversale et par une corde qui est inférieure en longueur à un diamètre extérieur dudit élément formant tube capillaire.

3. Dispositif de raccordement de fibres optiques se-



lon la revendication 1, dans lequel ledit moyen de serrage comprend une pince à ressort ayant la forme d'un U inversé et comprenant deux parties latérales reliées par une partie de serrage et dans lequel ladite partie de serrage comprend une partie centrale surbaissée qui lorsque ladite pince à ressort est disposée dans ladite deuxième position, est à même d'exercer des forces de compression sur les parties d'extrémité dénudées des fibres optiques dans la partie entaillée dudit élément formant tube capillaire.

4. Dispositif de raccordement de fibres optiques selon la revendication 3, dans lequel chacune desdites parties latérales de ladite pince à ressort comprend une partie dentée dirigée vers l'intérieur, propre à attaquer une première partie de verrouillage dudit étui pour maintenir ladite pince à ressort fixée audit étui pendant l'introduction, dans ledit élément formant tube capillaire, des parties d'extrémité des fibres optiques à raccorder et dans lequel ledit étui comprend également des parties de came formées le long de ladite partie médiane de celui-ci et susceptibles, lors de l'application de forces à la pince à ressort, dans ladite première position, d'amener chacune desdites parties dentées à glisser le long d'une desdites parties de came et à se déplacer vers l'extérieur et vers une deuxième partie de verrouillage, après quoi lesdites parties dentées sont encliquetées en contact de verrouillage avec lesdites deuxièmes parties de verrouillage pour maintenir ladite partie surbaissée en contact de serrage avec les parties dénudées des fibres optiques à raccorder.
5. Dispositif de raccordement de fibres optiques selon la revendication 4, dans lequel une face inférieure de la partie centrale de ladite pince à ressort est pourvue d'une matière souple qui attaque les parties dénudées des fibres optiques dans la rainure lorsque la pince à ressort se trouve dans la deuxième position.
6. Dispositif de raccordement de fibres optiques selon la revendication 5, dans lequel ledit passage dans ledit élément formant tube capillaire est interrompu par ladite entaille, de sorte que ladite entaille comprend une partie plane, une partie dudit passage s'étendant sous la forme de ladite rainure le long de ladite partie plane pour recevoir les parties d'extrémité dénudées des fibres optiques à raccorder.
7. Connecteur de fibres optiques selon la revendication 6, dans lequel les parois d'extrémité opposées dudit étui comprennent chacune un canal tronconique qui communique avec un orifice éva-

sé dans ladite paroi d'extrémité dudit étui et avec la cavité dudit étui dans laquelle est disposé ledit élément formant tube capillaire.

8. Milieu de transmission à fibres optiques raccordées qui comprend un premier milieu de transmission à fibre optique (30) et un deuxième milieu de transmission à fibre optique (30) comportant une partie d'extrémité qui est raccordée à une partie d'extrémité dudit premier milieu de transmission, lesdits milieux de transmission à fibres optiques raccordés étant caractérisés par un dispositif de raccordement de fibres optiques (20) selon la revendication 1.

Patentansprüche

1. Spleißvorrichtung (20) für optische Fasern mit folgenden Merkmalen:
ein Kapillarrohr (24), welches im wesentlichen zylindrisch ist und dabei eine Längs-Mittelachse (85) bildet, ferner einen Kanal (81) aufweist, der durch Endteile (42-42) hindurchreicht, um zu spleißende optische Fasern (30-30) zu halten, wobei der Kanal (81) parallel zur Längs-Mittelachse (85) verläuft, das Kapillarrohr (24) einen Schlitz aufweist, der sich quer zu dem Rohr erstreckt und zwischen seinen Endteilen mit einem Nutbereich (88) versehen ist, der kollinear zum Kanal ausgebildet ist und mit dem Kanal in den Endteilen des Kapillarrohrs in Verbindung steht, der Nutbereich in einer der Oberflächen gebildet ist, welche den Schlitz definieren, und ausgebildet ist, um die Endteile der zu spleißenden optischen Fasern zu halten; und
ein Gehäuse (22) mit einem Hohlraum (78), in welchem das Kapillarrohr angeordnet ist, dadurch gekennzeichnet,
daß das Gehäuse eine an der Klammereneinrichtung (26) angreifende Einrichtung aufweist, um die Klammereneinrichtung in einer offenen Stellung mit Bezug auf das Kapillarrohr (24) zu halten, in welcher die Klammereneinrichtung (26) von den Endteilen der Faser entfernt ist, wenn sich diese in der Nut (88) befinden,
daß die Klammereneinrichtung am Gehäuse in eine zweite Stellung bewegbar ist, in welcher sie im Klemmeingriff zu den Endteilen der in der Nut gelegenen Fasern steht, und
daß das Gehäuse (22) einen mittleren Bereich (44) mit einem abgerundeten Teil (67) aufweist, das auf der entgegengesetzten Seite des Kapillarrohrs von der Nut gelegen ist, zu den Enden der Faserendteile ausgerichtet ist und mit der Ausbildung des Kapillarrohrs im Sinne einer Linsenfunktion zusammenarbeitet, um die visuelle Inspektion der Nähe der Spleißung über den



abgerundeten Teil (67) des Gehäuses (22) und des Kapillarrohrs (24) zu erleichtern.

2. Spießvorrichtung für optische Fasern nach Anspruch 1, dadurch gekennzeichnet, daß der Kanal exzentrisch mit Bezug auf die Längsmittelachse angeordnet ist und daß der Schlitz so geformt ist, daß er in einem querliegenden Querschnitt des Kapillarrohrs, und zwar senkrecht zur Längsmittelachse, der verbleibende Teil des Kapillarrohrs, nachdem der Schlitz gebildet worden ist, mehr als die Hälfte der Querschnittsfläche beträgt und durch den Teil eines Kreises definiert wird, der länger als die Hälfte des Umfangs des Querschnitts ausmacht, und eine Sehne, die kürzer als der äußere Durchmesser des Kapillarrohrs ist.

3. Spießvorrichtung für optische Fasern nach Anspruch 1, dadurch gekennzeichnet, daß die Klammereinrichtung eine Federklammer in Form eines umgekehrten U und mit zwei seitlichen Teilen aufweist, die mit einem Klammerteil verbunden sind, und daß der Klammerteil einen niedergedrückten, zentralen Bereich aufweist, der bei Anordnung der Federklammer in der zweiten Stellung zur Anlage von Druckkräften an die freigelegten Endteile der optischen Faser im geschützten Teil des Kapillarrohrs dient.

4. Spießvorrichtung für optische Fasern nach Anspruch 3, dadurch gekennzeichnet, daß die jeweiligen seitlichen Teile der Federklammer einen nach innen gerichteten, verzahnten Teil aufweisen, der zum Eingriff in ein erstes Verriegelungsteil des Gehäuses ausgebildet ist, um die Federklammer am Gehäuse während der Einfügung in das Kapillarrohr der Endteile der zu spießenden optischen Fasern gesichert zu halten, und daß das Gehäuse außerdem Nockenteile umfaßt, die entlang des mittleren Bereichs gebildet sind und die bei der Anlage von Kräften auf die Federklammer in der ersten Stellung die jeweiligen gezähnten Teile dazu bringen, entlang und über die zugehörigen Nockenteile zu rutschen und nach außen und in eine zweite Verriegelungsstellung gestoßen zu werden, woraufhin die verzahnten Teile in Verriegelungseingriff mit den zweiten Verriegelungsteilen einfallen, um den niedergedrückten Teil in Klemmeingriff mit den freigelegten Teilen der zu spießenden optischen Fasern zu halten.

5. Spießvorrichtung für optische Fasern nach An-

spruch 4, dadurch gekennzeichnet, daß die Unterseite des mittleren Bereichs der Federklammer mit einem nachgiebigen Material versehen ist, welches an den freigelegten Teilen der optischen Fasern in der Nut anliegt, wenn die Federklammer in der zweiten Stellung ist.

6. Spießvorrichtung für optische Fasern nach Anspruch 5, dadurch gekennzeichnet, daß der Kanal in dem Kapillarrohr durch den Schlitz so unterbrochen wird, daß dieser einen ebenen Bereich aufweist, wobei ein Teil des Kanals als die Nut sich entlang dem ebenen Bereich erstreckt, um die freigelegten Endteile der zu spießenden optischen Fasern aufzunehmen.

7. Optischer Faserverbinder nach Anspruch 6, dadurch gekennzeichnet, daß entgegengesetzte Endwandungen des Gehäuses jeweils einen sich verjüngenden Kanal umfassen, der mit einer sich ausweitenden Öffnung in der Endwandung des Gehäuses und mit dem Hohlraum des Gehäuses in Verbindung steht, in welchem das Kapillarrohr angeordnet ist.

8. Gespießte optische Faser in Medien, die ein erstes optisches Faser-Übertragungsmedium (30) und ein zweites optisches Faser-Übertragungsmedium (30) mit einem Endteil aufweisen, der an ein Endteil des ersten Übertragungsmediums gespießt ist, wobei die gespießten optischen Faserübertragungsmedien durch eine Spießvorrichtung (30) für optische Fasern gemäß Anspruch 1 gekennzeichnet sind.