

Description

This invention relates to optical fibre distribution and in particular but not exclusively to branched networks for optical telecommunications.

Presently optical fibres are utilised in trunk lines for telecommunications but it is desirable to have optical transmission within other points in a network, such as in branches between an exchange and a subscriber. Elements in such branches need to be reliable under the extremes of ambient temperature and to permit broad spectrum transmission over the range of wavelengths utilised, at present usually 1300 to 1550nm. It is also necessary to ensure that minimum losses occur due to macrobending as optical fibres emerge from branching elements such as couplers.

Our co-pending British application No. 8827348.7 describes an optical fibre distribution arrangement comprising a coupling array and a splice organiser associated with each input and output line of the coupling array, the splice organisers being mounted to a supporting frame and capable of limited relative movement with respect to one another so as to permit access to the splices stored therein. A splice organiser described in the application comprises a tray having a groove for retaining a splice and recesses for confining loops of optical fibre under their own natural resilience. In this splice tray there is only one entry/exit port for the fibre, which port is located at one corner. However, in some instances it would be preferably to be able to have a choice of entry and/or exit port from a number of alternatives. In this case it is desirable that means be provided for the fibre to be routed to the alternative entry/exit ports in such a way that significant optical loss from the fibre due to macrobending is avoided. It is additionally desirable that there are a number of alternative routes to each alternative entry/exit port.

EP-A-281 196 describes a fibre storage device in which a length of spare fibre can be stored by looping the spare fibre into a flat storage space. The storage space is subdivided into two storage regions.

The present invention provides a splice organiser comprising a tray having a plurality of formers each curved with at least the minimum bend radius of optical fibres so that significant optical loss from the fibres is avoided, a groove for retaining a splice, and at least one recess for confining loops of optical fibre under their own natural resilience, the or each recess being positioned between a respective pair of adjacent formers and being sized and shaped to confine loops of optical fibre having radii of curvature exceeding the minimum bend radius, and in which a plurality of guide tracks are provided to enable fibres to

enter or exit the organizer at any one of a plurality of ports, characterized in that the formers are raised above a major surface of the tray, and the guide tracks are recessed in said major surface, the guide tracks describing paths around the formers and leading to the ports, with the disposition of the formers and the guide tracks being such that spare loops of fibre associated with the splice can be coiled up and placed around a former, so as to overlie fibre in the recessed guide tracks.

The invention is now described by way of example with reference to the accompanying drawings in which:

Figure 1 is a side view of a preferred embodiment of a splice organizer according to the invention;

Figure 2A shows a detail of one feature of the preferred embodiment;

Figure 2B is a cross-sectional view of the feature shown in Figure 2A; and

Figure 3 shows a further feature of the preferred embodiment.

Figure 1 shows a preferred splice organiser which enables a single splice 16 to be stored on one side of an organiser and fibre to enter or exit the organiser at any one of the four entry/exit ports 27 located at the four corners of the tray. The organiser comprises a tray 13 having a central raised, substantially circular former 14, and two raised curved end formers 15, the splice 16 being positioned in a splice retaining groove located, as shown, on a long side of the organiser. The fibres enter and pass out of the organiser along any one of separate channels 17 which lead to each of the four corners of the tray. Spare loops of fibre on each side of the splice are stored in the organiser by forming coils of fibre and placing these over the former 14 after passing the first bend after the splice around the outer side of the curved end former 15. Alternative winding patterns around both the end formers or over one end former and the opposite side of the central former may also be used, but several turns should preferably be placed over the central former, and it is preferable to have a single length of fibre close to the splice passing along a separate channel.

The natural resilience of the fibres will cause the coils placed over the central former to expand outwardly into a configuration of varying diameter turns. This procedure is then repeated for the fibre on the other side of the splice. Care has to be taken not to coil the fibres over-tightly in the first instance. In the situation where only the first bend of the fibre after the splice has been passed around the outer side of the curved former, or another channel is provided, the organiser presents a separate track 18 to facilitate non-destructive testing eg via 'Clip-On' (Trade Mark) access technol-

ogy, see PCT patent application WO 88/07689, should it be necessary for any reason to gain access to the data transmission along the fibre. A route map may be used to determine on which side of the splice the fibre is to be tested, and a suitable tool may be used for lifting the fibre out of the track. This arrangement ensures that access is gained at a point on the fibre relatively close to the splice, so that if the fibre is in any way damaged by the action of gaining 'Clip-On' access, it is simple to discard the damaged length of fibre, adjust the spare coils, and form a new splice without losing much fibre, thus avoiding the possibly serious mistake of damaging and having to discard a much longer portion of the spare fibre.

Each of the channels 17 is connected to a recessed semicircular track 23 which extends between the two channels 17 at each short end of the organiser. The tracks 23 touch further recessed semicircular tracks 24 at their mutual mid points. Recessed longitudinal tracks 25 extend between the channels 17 disposed along the same long side of the organiser. With this arrangement a fibre in the organiser can be routed to or from any channel 17. For example consider a fibre, wound clockwise as viewed around the central former 14. This fibre may be routed tangentially from the former 14 along the tracks 25 to exit via either the top right or bottom left (as viewed) channel 17. Alternatively the fibre may be guided into one of tracks 24 and then diverted into the intersecting track 23, the fibre undergoing an inflexion, to exit at the bottom right or top left channel 17. Corresponding entry routes apply, and analogous routing for anti-clockwise wound fibre is also possible. The fibres to be spliced are routed through the organiser by laying them in the recessed tracks in a suitable route from the chosen entrance, via the splice 16, to the chosen exit of the organiser; the spare loops of fibre then being coiled up and laid over the central former 14, thus overlying the fibres in the recessed tracks.

Each of the recessed tracks 23, 24 and 25, may have small tabs or clips 21 which retain the fibre in the track. Larger clips 26 may also be provided to retain the spare loops of fibre around the central former 14.

At each corner of the splice organiser the channels 17 are connected to short lengths of tube 19 which fit through holes 27 in the tray 13. These tubes are shown in Figure 2A, which shows a side view of a tube 19, and in Figure 2B, which shows a cross-sectional view of the tube. Each tube is formed with a longitudinal slit 20, and a longitudinal taper of the order of half a degree along at least part of its length, which is provided for ease of removing the tubes from their mould during manufacture. Capillaries for supporting the fibres are

then passed through the tube before the tube is pushed into a hole 27 at one corner of the tray. These holes have a slightly smaller diameter than that of the tubes so that the slit 20 is forced to close, and the final circumferences of the tube and the hole match when the tube is pushed in until the tube abuts the end of channel 17.

The tubes 19 constitute hinge pins, by which means the splice organisers 2 can be pivotally mounted on a supporting frame (not shown). Furthermore, as shown in Figure 3, a hinged or clip-on lid 22 may be provided to cover the organiser, the lid pivoting on the tubes 19, or the organiser may be arranged to co-operatively engage with an adjacent organiser so that the confronting organisers effectively form covers for each other. The reverse side of the organiser preferably has a similar or identical configuration for storing another splice and associated fibre.

A plurality of the preferred splice organisers may be mounted to a supporting frame so as to be capable of limited relative movement with respect to one another and hence permit access to the splices stored therein.

By way of example the dimensions for a preferred embodiment of the splice organiser will now be given. The overall dimensions are approximately 172mm long by 78mm wide, referring to Figure 1, and 8mm deep, referring to Figure 3. The central former 14 is about 60mm in diameter, hence defining a minimum bend radius for primary coated optical fibre which prevents significant optical loss, due to macrobending, from the fibre when it is positioned around the former. The guide tracks 18, 23, 24 and 25 are approximately 1mm wide and vary in depth from about 1mm to about 2mm. The curved tracks 18, 23 and 24 have a radius of curvature of 35mm again chosen to avoid optical loss from the optical fibres due to macrobending.

The splice retaining groove 16 is about 2.4mm wide and about 70mm long to give a snug fit for a conventional heat shrink protected fibre splice.

The tube 19 has an outer diameter of about 1mm and an inner diameter of about 0.5mm. The face of the splice tray shown in Figure 1 is substantially planar to enable adjacent trays to be stacked closely together without wasted space. Typically a tray will have a bow over its whole length of less than about 0.5mm.

The splice tray 13 is preferably moulded from acrylonitrile butadiene styrene (ABS). The tubes 19 are constructed from polyvinylidene fluoride (PVDF) and the lid 22 is formed from a clear polymer such as an acrylic resin.

Claims

1. A splice organiser comprising a tray (13) having a plurality of formers (14, 15) each curved with at least the minimum bend radius of optical fibres so that significant optical loss from the fibres is avoided, a groove for retaining a splice (16), and at least one recess for confining loops of optical fibre under their own natural resilience, the or each recess being positioned between a respective pair of adjacent formers and being sized and shaped to confine loops of optical fibre having radii of curvature exceeding the minimum bend radius, and in which a plurality of guide tracks (18, 23, 24, 25) are provided to enable fibres to enter or exit the organiser at any one of a plurality of ports (27), characterised in that the formers are raised above a major surface of the tray, and the guide tracks are recessed in said major surface, the guide tracks describing paths around the formers and leading to the ports, with the disposition of the formers and the guide tracks being such that spare loops of fibre associated with the splice can be coiled up and placed around a former, so as to overlie fibre in the recessed guide tracks.
2. A splice organiser as claimed in claim 1, wherein the radius of curvature of the guide tracks (18, 23, 24, 25) is such as to avoid significant optical loss in fibres in the guide tracks.
3. A splice organizer as claimed in claim 1 or claim 2, wherein the tray (13) is generally rectangular, and at least one port (27) is provided at each corner of the tray.
4. A splice organiser as claimed in any one of claims 1 to 3, wherein the organizer is provided with a substantially central, circular former (14) and a pair of curved end formers (15), a respective recess being positioned between the central former and each of the end formers.
5. A splice organizer as claimed in claim 4, wherein the splice-retaining groove is positioned adjacent to the central former (14), whereby one loop of the fibre on either side of the splice can be passed separately round a respective one of the end formers (15).
6. A splice organizer as claimed in claim 4 or claim 5, wherein tubes (19) fitted at corners of the tray (13) constitute hinge pins by which the splice organizer can be pivotally mounted to a

frame, and the tubes accommodate capillary tubes for conducting fibres into the splice organiser.

7. A splice organizer as claimed in claim 6, wherein the tubes (19) form means whereby a hinged or clip-on lid may be fitted to the splice organizer.
8. A splice organizer as claimed in any one of claims 1 to 7, wherein the or each recess is sized to occupy substantially at least as much area as would be encompassed by a complete loop of minimum bend radius optical fibre.

Patentansprüche

1. Eine Spleißverteilvorrichtung, die aufweist: eine Aufnahmeplatte (13) mit einer Vielzahl von Formen (14, 15), wobei jede mit mindestens dem minimalen Biegeradius der optischen Faser so gekrümmt ist, daß ein signifikanter optischer Verlust der Fasern vermieden wird, eine Nut zum Halten einer Spleißung (16) und mindestens eine Vertiefung zum begrenzenden Aufnehmen von Schleifen einer optischen Faser unter ihrer eigenen natürlichen Elastizität, wobei die Vertiefung oder jede Vertiefung zwischen einem jeweiligen Paar benachbarter Former angeordnet ist und so dimensioniert und geformt ist bzw. sind, daß Schleifen einer optischen Faser eingrenzend aufgenommen sind, die einen Krümmungsradius aufweisen, die den minimalen Biegeradius übersteigen, und in welcher eine Vielzahl von Führungsbahnen (18, 23, 24, 25) vorgesehen sind, damit die Fasern die in die Verteileinrichtung an irgendeiner einer Vielzahl von Öffnungen (27) eintreten bzw. aus ihr austreten können, **dadurch gekennzeichnet**, daß die Former über eine Hauptoberfläche der Aufnahmeplatte angehoben sind und die Führungsbahnen in der Hauptoberfläche eingelassen sind, wobei die Führungsbahnen einen Weg um die Former bilden und zu den Öffnungen führen, wobei die Anordnung der Former und der Führungsbahnen derart ist, daß Ersatzschleifen der Faser, die der Spleißung zugeordnet sind, aufgewickelt werden können und um einen Former angeordnet werden können, so daß sie über einer Faser in den abgesenkten Führungsbahnen liegt.
2. Spleißverteilvorrichtung nach Anspruch 1, wobei der Krümmungsradius der Führungsbahnen (18, 23, 24, 25) so ist, daß ein signifikanter optischer Verlust in den Fasern in den Führungsbahnen vermieden wird.



3. Spleißverteilvorrichtung nach Anspruch 1 oder 2, wobei die Verteilerplatte (13) im allgemeinen rechtwinklig ist und mindestens eine Öffnung (27) an jeder Ecke der Verteilerplatte vorgesehen ist.
4. Spleißverteilvorrichtung nach einem der Ansprüche 1 bis 3, wobei die Verteilvorrichtung mit einem im wesentlichen zentralen kreisförmigen Former (14) und einem Paar gekrümmter Endformer (15) versehen ist, wobei eine jeweilige Absenkung zwischen dem zentralen Former und jedem der Endformer angeordnet ist.
5. Spleißverteilvorrichtung gemäß Anspruch 4, wobei die Spleißhaltenut neben dem Zentralformer (14) angeordnet ist, wodurch eine Schleife der Faser auf jeder Seite der Spleißung separat um einen jeweiligen Endformer (15) geleitet werden kann.
6. Spleißverteilvorrichtung gemäß Anspruch 4 oder 5, wobei Rohre (19) an Ecken der Aufnahmeplatte (13) angebracht sind, die Scharnierstifte darstellen, durch die die Spleißverteilvorrichtung schwenkbar an einem Rahmen montiert sein kann, und die Rohre Kapillarrohre zum Leiten von Fasern in die Spleißverteilvorrichtung aufnehmen.
7. Spleißverteilvorrichtung gemäß Anspruch 6, wobei die Rohre (19) eine Einrichtung bilden, wodurch ein Scharnier- oder Klemmdeckel an der Spleißverteilvorrichtung befestigt sein kann.
8. Spleißverteilvorrichtung gemäß einem der Ansprüche 1 bis 7, wobei die oder jede Vertiefung so dimensioniert ist, daß sie im wesentlichen mindestens so viel Fläche einnimmt, als durch eine vollständige Schleife einer optischen Faser mit einem minimalen Biegeradius eingenommen werden würde.

Revendications

1. Un organisateur d'épissures ou platine d'assemblage comprenant un plateau (13) muni d'une pluralité de gabarits (14, 15), chacun d'eux incurvé, au moins, suivant le rayon minimum de pliage des fibres optiques, de manière à éviter les pertes optiques significatives des fibres, une rainure de retenue de l'épissure (16) et, au moins, une cavité pour confiner les boucles de fibre optique sous leur propre élasticité naturelle, la ou chaque cavité étant positionnée entre une paire respective de gabarits adjacents et étant dimensionnée et

conformée de manière à confiner les boucles de fibre optique dont les rayons de courbure sont supérieurs au rayon de courbure minimum, et dans lesquels il est ménagé une pluralité de voies de guidage (18, 23, 24, 25) pour permettre aux fibres de pénétrer ou de sortir de la platine par l'un quelconque d'une pluralité d'orifices (27), caractérisé en ce que les gabarits sont en saillie au dessus de la surface principale du plateau, les voies de guidage décrivant des trajets autour des gabarits et conduisant aux orifices, la disposition des gabarits et des voies de guidage étant telle que des boucles de réserve de fibre associées à l'épissure peuvent être enroulées et placées autour d'un gabarit de manière à recouvrir la fibre dans les voies de guidage en creux.

2. Un organisateur d'épissures ou platine d'assemblage selon la revendication 1, dans lequel le rayon de courbure des voies de guidage (18, 23, 24, 25) est tel qu'il évite les pertes optiques significatives des fibres dans les voies de guidage.
3. Un organisateur d'épissures ou platine d'assemblage selon la revendication 1 ou 2, dans lequel le plateau (13) est généralement rectangulaire et il est prévu, au moins, un orifice (27) à chaque angle du plateau.
4. Un organisateur d'épissures ou platine d'assemblage selon l'une quelconque des revendications 1 à 3, dans lequel la platine est pourvue d'un gabarit circulaire, sensiblement central (14) et d'une paire de gabarits d'extrémité courbes (15), une cavité respective étant disposée entre le gabarit central et chacun des gabarits d'extrémité.
5. Un organisateur d'épissures ou platine d'assemblage selon la revendication 4, dans lequel la rainure de retenue d'épissure est disposée adjacente au gabarit central (14) de manière qu'une boucle de la fibre, de chaque côté de l'épissure, puisse être passée séparément autour d'un des gabarits d'extrémité respectifs (15).
6. Un organisateur d'épissures ou platine d'assemblage selon la revendication 4 ou 5, dans lequel les tubes (19) montés aux angles du plateau (13) constituent des axes d'articulation permettant d'assurer le montage à rotation de la platine sur un châssis, et les tubes reçoivent des tubes capillaires pour acheminer les fibres dans la platine d'assemblage.



7. Un organisateur d'épissures ou platine d'assemblage selon la revendication 6, dans lequel les tubes (19) constituent des moyens permettant de monter un couvercle articulé ou agrafé sur la platine d'assemblage.

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8. Un organisateur d'épissures ou platine d'assemblage selon l'une quelconque des revendications 1 à 7, dans lequel la ou chaque cavité est dimensionnée de manière à occuper sensiblement, un espace équivalent à celui qui serait couvert par une boucle complète de fibre optique au rayon minimum de courbure.

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