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Assembly and Method for use in
Terminating an Optical Fibre or Fibres

5 This invention relates to an assembly for use in terminating an optical fibre or optical fibres.

The use of optical fibres as a signal -carrying medium for communications is now extremely widespread and continues to increase. Optical fibres are used not only in cables which interconnect geographically separated locations, but also within buildings themselves. As such there is a
10 need for an optical fibre termination which can be used in the field in order to terminate an optical fibre or fibres.

According to a first aspect of the present invention there is provided an assembly for use in terminating an optical fibre comprising a housing which can receive the optical fibre to be terminated so that it is located in alignment
15 with a length of another optical fibre, or an optoelectronic device, said housing including a compartment through which the optical fibre to be terminated can extend, said compartment being designed to receive a heat responsive adhesive element and a thermally conductive element, which can be coupled to a source of energy so that heat in the thermally conductive element causes the adhesive
20 to melt and flow around the optical fibre to secure it in position.

According to a second aspect of the present invention there is provided an assembly for use in terminating an optical fibre comprising an outer body member, a first member locatable within said body member, said first member carrying a length of optical fibre which protrudes therefrom, a housing
25 locatable in alignment with the first member, an optical fibre alignment means for receiving the end of the length of optical fibre which protrudes from the first member, said housing having an access opening for receiving an optical fibre to be terminated so that said fibre can be located in the alignment means

so as to be aligned and abutted with the optical fibre length, said housing including a compartment through which the optical fibre to be terminated extends, said compartment being designed to receive a heat responsive adhesive element and a thermally conductive element, which can be coupled to a source of energy so that heat in the thermally conductive element causes the adhesive to melt and flow around the optical fibre to secure it in position. By heat responsive adhesive is meant a material which in the presence of heat can assume a condition in which it can flow or be caused to flow and subsequently harden again on cooling in order to secure an optical fibre in position.

10 The compartment may accommodate said heat responsive adhesive, said thermally conductive element, and an electrically conductive element.

 The compartment may accommodate said heat responsive adhesive and said thermally conductive element, access to said compartment being provided for a heat source. The electrically conductive element may be a resistor.

15 The thermally conductive element may be a metallic element. The thermally conductive element may be a saddle which straddles the adhesive element.

 The outer body member may include one or more openings so located as to allow connection of an electrical power source to said electrically conductive element or thermal contact to an external heat source.

20 The plug assembly may be used to terminate more than one optical fibre. The assembly may include a plurality of optical fibre alignment elements. The alignment element or elements may comprise a sleeve or sleeves, a V groove or grooves, ceramic or metal ferrules, glass capillary triple rod aligners or a combination of these.

25 A third aspect of the present invention provides a method of terminating an optical fibre or fibres using an assembly according to any preceding claim, which comprises positioning the end of an optical fibre to be terminated in said

housing so it is in alignment with the length of the other optical fibre, or optoelectronic device, heating said thermally conductive element such that the adhesive assumes the state in which it can flow around the optical fibre to be terminated and secured in position in alignment with the optical fibre length.

5 The invention will be described now by way of example only, with particular reference to the accompanying drawings. In the drawings:

Figure 1 is an exploded view of an assembly in the form of a plug assembly in accordance with an embodiment of the present invention;

Figure 2 is a perspective view of the plug assembly;

10 Figure 3 is a side elevation of the plug assembly;

Figure 4 is a section on the line 4-4 of Figure 3;

Figure 5 is a sectional view on the line 5-5 of Figure 3;

Figure 6 is a perspective view showing a modification of a component in the plug assembly of Figure 1;

15 Figures 7 to 10 show a modification of the embodiment of Figure 1, and

Figure 11 shows a modified form of saddle.

Referring to Figures 1 to 5 a plug assembly for use in terminating an optical fibre or optical fibres comprises an outer body member (10), a first member part (11) and a housing part (12). These parts can all be moulded from suitable plastics materials.

20 The outer body member has a body portion (14) which defines therein a space of generally rectangular cross-section which can receive the first member (11). Two opposite side walls of the body portion (14) each have an aperture (16) formed therein at a generally central location. The open end of the body portion (14) has four longitudinally extending slots identified by reference number (18), the slots being arranged so that one is formed in each of the walls of the body portion (14).

The internal surface of the body portion (14) is formed with a step (20) which is illustrated in Figure 5 of the drawings. The top wall of the body portion (14) can have a transparent section (19).

5 The other end of the outer body member (10) has an enlarged portion (21) which is formed integrally with the body portion (14). In the top wall of the enlarged portion (21) are formed two spaced through holes (22). Internally, as shown in Figure 4, opposite side walls of the body portion (21) have steps shown at (54). The lower wall of the portion (21) has an integrally formed resilient catch element (25) which can be used to secure the plug assembly in
10 another part of an optical fibre connector in a manner which will be apparent to those skilled in the art.

The first member (11) comprises a main body portion (30) of generally rectangular cross-section and an end portion (31) whose dimensions are slightly greater than the body portion (30) so that a step (32) is formed around their
15 junction. The first member (11) has secured therein a pair of optical fibre lengths (35) which at one end are substantially flush with an end face (36) of the first member and at the other end protrude from the end portion (31) as illustrated in Figure 1. Also the first member (11) has two longitudinally extending bores formed therein, these extending for the full length of the body.

20 The housing part (12) has a first generally channel-shaped section (40) from one end of which projects a pair of spaced pins (41, 42). The channel section (40) defines a compartment (43) which can receive a pair of optical fibre alignment elements in the form of a pair of guide sleeves (44, 45) which preferably are optically transparent. Each guide sleeve has a through bore with
25 a diameter corresponding to that of an optical fibre. The ends of each bore are widened to facilitate insertion of an optical fibre. One side wall of the channel-shaped section has an outwardly extending projection (38).

The housing part (12) also includes an end housing part (46) which is

formed integrally with the channel-shaped section (40). The end part (46) defines a compartment (47). The lower surface of the compartment (47) defines two side-by-side grooves (48, 49) in which can locate the protective outer sleeves (50, 51) of two optical fibres (52, 53), which are to be
5 terminated. The outer surface of opposite side walls of the end part (46) are stepped at (24). The end wall (55) of the end part (46) has formed therein an aperture (56). The compartment (47) can accommodate above the optical fibres (52,53) and sleeves (50,51) a heat responsive adhesive in the form of a glue pellet (57) which is straddled by a thermally conductive saddle (58) on top of
10 which is located an electrical resistor (59) which has conductive pads (60, 61). The saddle may be formed from aluminium or other suitable thermally conductive material.

In order to assemble the plug assembly the pins (41, 42) on the housing part (12) are located within the longitudinally extending bores formed in the
15 first member (11), the housing part (12) is moved towards the first member (11) and the protruding parts of the optical fibres (35) locate into one end of the sleeves (44, 45), which sit within the compartment (43) of the housing part (12).

The assembly of the glue pellet (57), the saddle (58), and the resistor (59) are located in the compartment (47) as shown in Figure 4 of the drawings.
20 The first member (11) and housing part (12) are moved into the outer body member (10) so that they assume the position shown in Figure 5 of the drawings. It will be noted that this movement is arrested when the step (32) on the first member (11) comes into contact with the step (20) formed on the
25 interior surface of the outer body member (10). Also at this point the projection (38) on the channel-shaped section (40) locates within the opening (16) to secure the body parts in position. The step (24) on the outer surface of the end part (46) sits on the step (54) on the interior of the body portion (21).

In use the optical fibres to be terminated are fed through the aperture (56) in the end wall (55) into the compartment (47) so that the outer sleeves (50, 51) of the fibres sit within the grooves (48, 49) at the base of that compartment. The optical fibres (52, 53) which protrude from the sleeves (50, 51) are fed into the end of the sleeves (44, 45) until they meet and abut with the optical fibre lengths at a position shown at (65) in Figure 5.

Optical radiation is then passed through the optical fibres (52, 53) and the junction of the fibres (52, 53) with the optical fibre lengths (35) is detected through the transparent section (19) of the body member (10). If radiation is detectable, this is an indication that the fibres (52, 53) and optical fibre lengths (35) are not aligned and/or abutted correctly. They are then manipulated until the radiation is substantially extinguished indicating correct abutment and/or alignment. At this point an electrical power source is connected to the pads (60, 61) of the resistor by passing electrical conductive terminals of the power source through the apertures (22) formed in the portion (20) of the outer body member (10) so that they contact the pads (60, 61). Electrical current is passed through the resistor (59) which heats up the glue pellet (57) by way of the thermally conducting saddle (58). The power source is in the form of a tool which can be used to apply pressure to the resistor and hence the adhesive in order to cause it to flow around the fibres. The adhesive melts and flows around the optical fibres (52, 53). The thermally conducting saddle has a good thermal conductive bond with the resistor (59). When the current is interrupted the adhesive then resets to secure the fibres (52, 53) in their correct position in alignment and abutment with the optical fibre lengths (35).

It will be appreciated that the above described plug assembly represents a very convenient way of terminating optical fibres in the field since it is relatively simple to use.

The plug assembly as described above is used to terminate a pair of

optical fibres. It will be appreciated that the assembly can be used to terminate one or several optical fibres. Also the assembly as described includes a single compartment (47) for receiving the adhesive pellet. It will be appreciated that assemblies can be constructed which have more than one compartment.

5 Also the assembly as described is used to terminate optical fibres so that they are aligned with optical fibre lengths (35). It will be appreciated that the basic principle of activating a heat responsive adhesive by heating it using an electrically conductive element can be applied generally to many different types of optical fibre splice or connector and not just that described in the
10 above embodiment.

 An alternative form of saddle and resistive heating element is shown in Figure 6 of the drawings. In this arrangement the resistor and saddle are effectively combined into a single element.

 The arrangement shown in Figure 6 comprises a U-shaped member (80)
15 which is formed from ceramic material and which, in use, straddles the glue pellet (57) in much the same way as the saddle (58) of Figure 1.

 A pair of conductive contacts (82, 83) are formed on the upper surface of the U-shaped member (80) and a resistive element (85) extends around the upper surface between the contacts (82, 83).

20 In use the arrangement operates in a manner similar to that described for Figures 1 to 5. Electrically conductive terminals of a power source are passed through the apertures (22) of the portion (21) so that they contact the contacts (82, 83) on the U-shaped member (80). Electrical current from the power source is then passed through the resistive element (85) and the heat
25 generated is conducted through the U-shaped member (80) and melts the glue pellet which then flows around the fibres (52, 53).

 In the embodiment described with reference to Figures 1 to 5 the alignment means for the fibre lengths (36) and the fibres (52, 53) are sleeves

(44, 45).

It will be appreciated that other alignment means can be employed. One example is a V-groove type arrangement which is employed in an alternative embodiment illustrated in Figures 7 to 10. The connector shown in these Figures is similar to that of Figures 1 to 5, but the alignment is achieved using a pair of V-grooves (90, 91) formed in a component (92). The component (92) is located over the fibre ends to be aligned and abutted which are located on the base of the compartment (43). Each pair of fibres extends along one of the grooves (90, 91) in a manner which will be apparent to those skilled in the art. The component (92) is retained in position in the channel-shaped section (40) by a clip (94).

Other differences with respect to the first embodiment are the location of the aperture (16) and cooperating projection (38), the provision of slots (95) rather than holes (22) for the terminals or electrodes of the power source, and the provision of a cable clamp (96).

In the arrangements described above the resistor is accommodated in the compartment (47). It is possible to produce an embodiment in which the resistor is external to compartment. One example is illustrated in Figures 11. In this arrangement the saddle is formed with a thicker upper part (98) so that when located in the compartment (47) its upper surface is substantially flush with the upper edges of the walls of the compartment (47). In this example the body part (21) will have a rectangular opening corresponding in shape to the top surface of the saddle, instead of the holes (22).

In use an external resistor, which will be part of the power source, is located in that rectangular opening so that it rests against the upper surface of the saddle. When a current is passed through the resistor the adhesive is heated substantially as described before.

Alternatively the power source can be provided with a coil which can

be located against or near the saddle to heat the saddle inductively.

It will be appreciated that the embodiments described are MTRJ type connectors. The basic principle of using a heat responsive adhesive in conjunction with a thermally conductive element such as saddle (58) can be employed in other types of connector such as SC, LC, ST, LX5, MU, MTP, E200 connectors.

Claims:

1. An assembly for use in terminating an optical fibre comprising a housing (12) which can receive the optical fibre (52, 53) to be terminated so that it is located in alignment with a length of another optical fibre, or an optoelectronic device, said housing (12) including a compartment (47) through which the optical fibre to be terminated can extend, said housing being constructed to define a first access opening through which said compartment is accessible during assembling of the assembly from a position generally radial of the fibre, a heat responsive adhesive element (57) and a thermally conductive element (58), which can be placed in said compartment through said first access opening, said thermally conductive element being so arranged and located that, in use, it can be coupled to a source of energy whereby heat generated in the thermally conductive element causes the adhesive to melt and flow around the optical fibre to secure it in position.
2. An assembly according to claim 1, comprising an outer body member (10), a first member (11) locatable within said body member, said first member carrying said length of optical fibre (36) which protrudes therefrom, said housing (12) being locatable in alignment with the first member, an optical fibre alignment means (44, 45) for receiving the end of the length of optical fibre which protrudes from the first member, and said housing having a second access opening (56) for receiving the optical fibre to be terminated so that said fibre can be located in the alignment means so as to be aligned and abutted with the optical fibre length.
3. An assembly according to claim 1 or claim 2, wherein said compartment (47) accommodates said heat responsive adhesive (57), said thermally conductive element (58), and an electrically conductive element (59) which is so mounted that when an electrical current is passed through the electrically conductive element the heat in the thermally conductive element melts the adhesive.

4. An assembly according to claim 1 or claim 2, wherein said compartment (47) accommodates said heat responsive adhesive (57) and said thermally conductive element (58), access to said compartment being provided for a heat source to be coupled with the thermally conductive element.
5. An assembly according to claim 3, wherein said electrically conductive element (59) is a resistor.
6. An assembly according to any preceding claim, wherein the thermally conductive element (58) is a metallic element.
7. An assembly according to any preceding claim, wherein the thermally conductive element (58) is a saddle which straddles the adhesive element.
8. An assembly according to claim 1 or claim 2, wherein the source of energy is an induction coil carried by a suitable tool.
9. An assembly according to claim 1 or claim 2, wherein the thermally conductive element is a ceramic saddle (80) which is provided with resistive portions to which an electrical current can be applied.
10. An assembly according to any one of claims 2 to 9, wherein the outer body member (10) includes one or more openings (22) so located as to allow either connection of an electrical power source to said electrically conductive element, or the application of an external energy source.

11. An assembly according to any preceding claim, which is arranged to terminate more than one optical fibre.

12. An assembly according to claim 10, including a plurality of compartments for receiving the adhesive element.

13. A method of terminating an optical fibre or fibres using an assembly according to any preceding claim, which comprises positioning the end of an optical fibre (52, 53) to be terminated in said housing (12) so it is in alignment with the length of the other optical fibre (35), or optoelectronic device, heating said thermally conductive element (58) such that the adhesive assumes the state in which it can flow around the optical fibre to be terminated and secured in position in alignment with the optical fibre length.

14. A method according to claim 13, including sensing alignment of the optical fibre to be terminated with the optical fibre length by passing radiation along the fibres and observing the level of radiation detectable at the junction of the optical fibre and the optical fibre length.