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(54) Optical fibre connector ferrule holder with tines

(57) A ferrule holder 30 of an optical fibre connector has an elongate tubular body. One end of the body has a plurality of coaxially extending tines 34 arranged to permit the insertion of a ferrule 22 therebetween. An annular or part annular compression element 38 is a force fit over the tines thereby to effect clamping of the ferrule between the tines. Housing or coupling nut 10, compression spring 18 and flanges 12, 40 are shown. Female 22 may have a recess (42, Fig. 5).

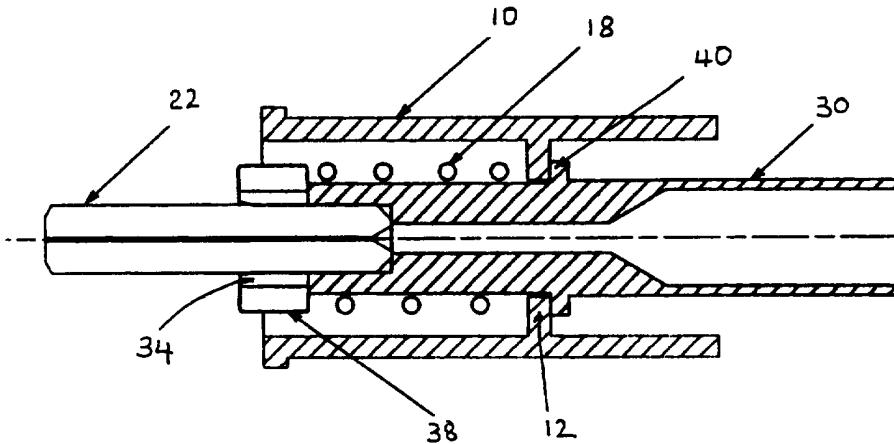


FIG. 2

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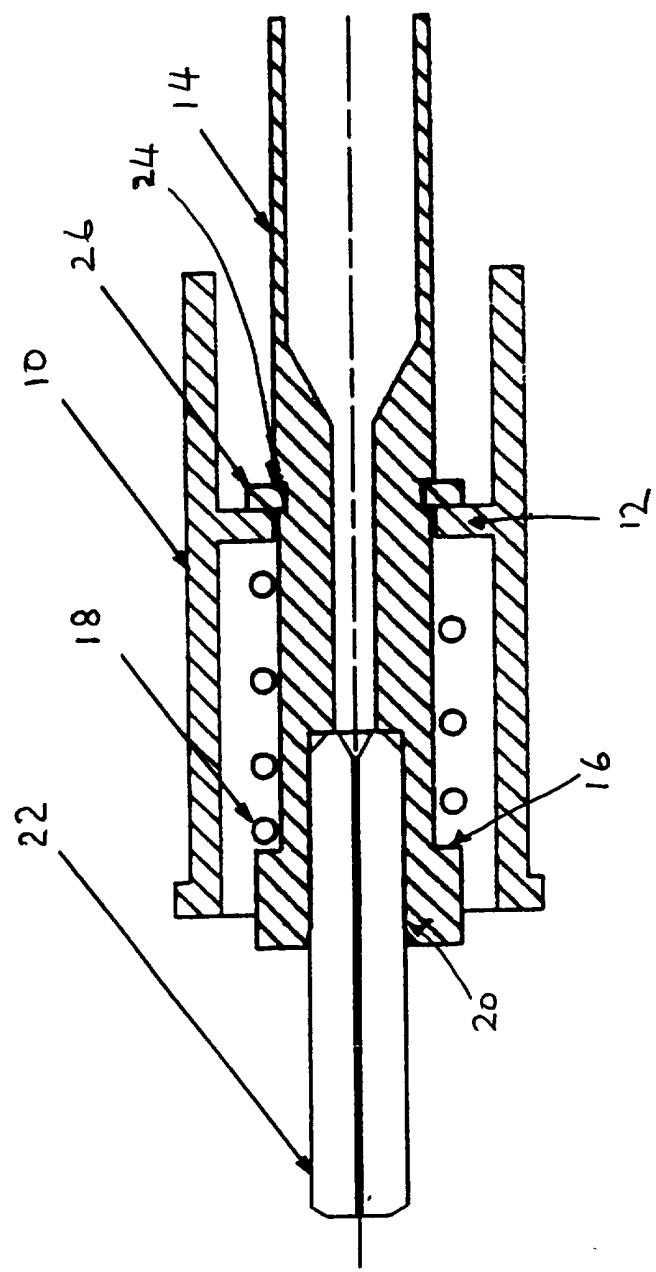


FIG. 1

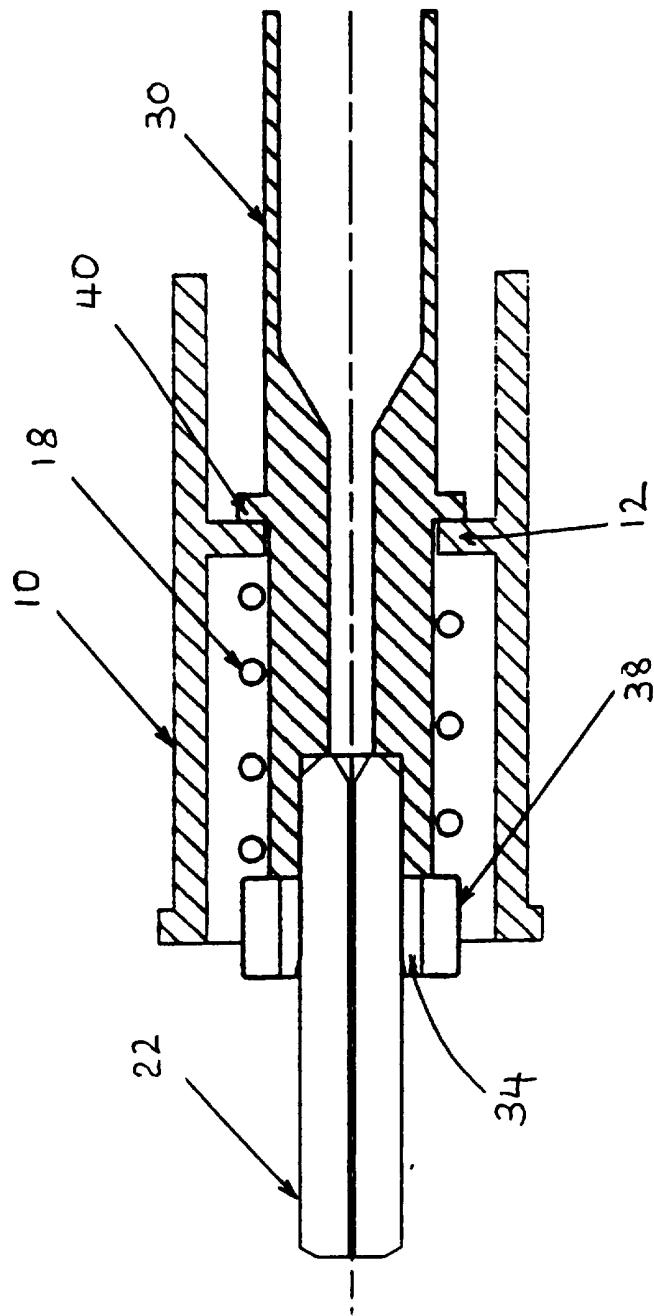


FIG. 2

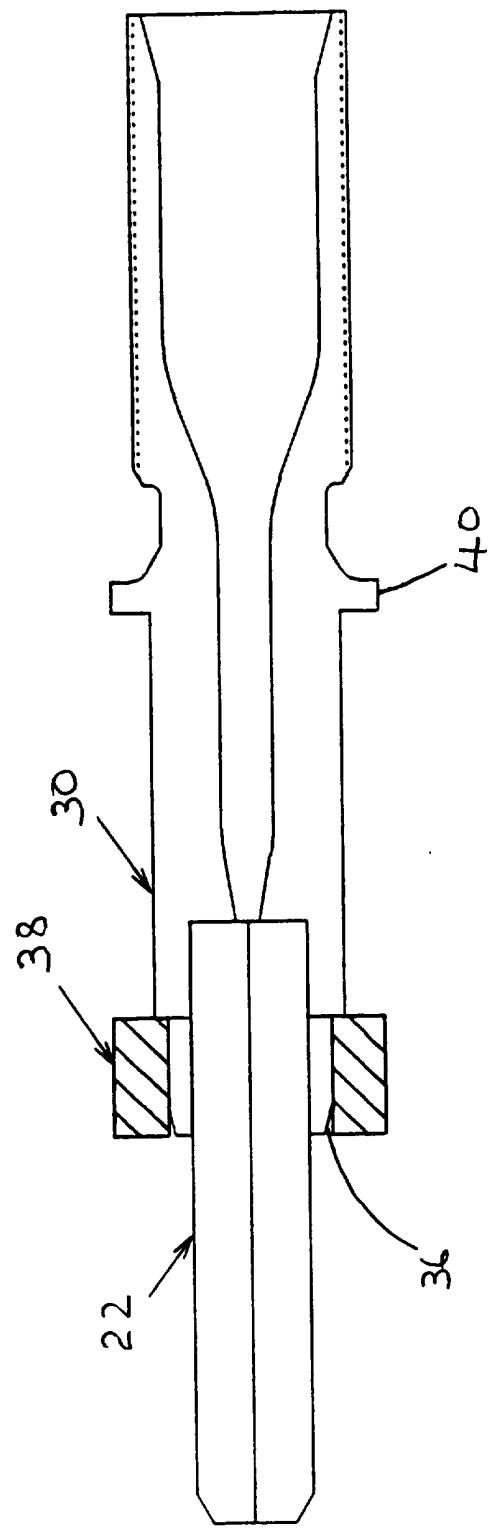


FIG. 3

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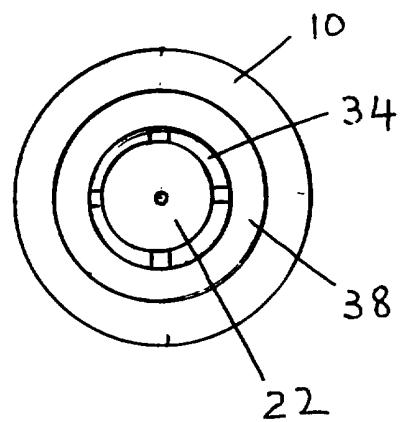


FIG. 4

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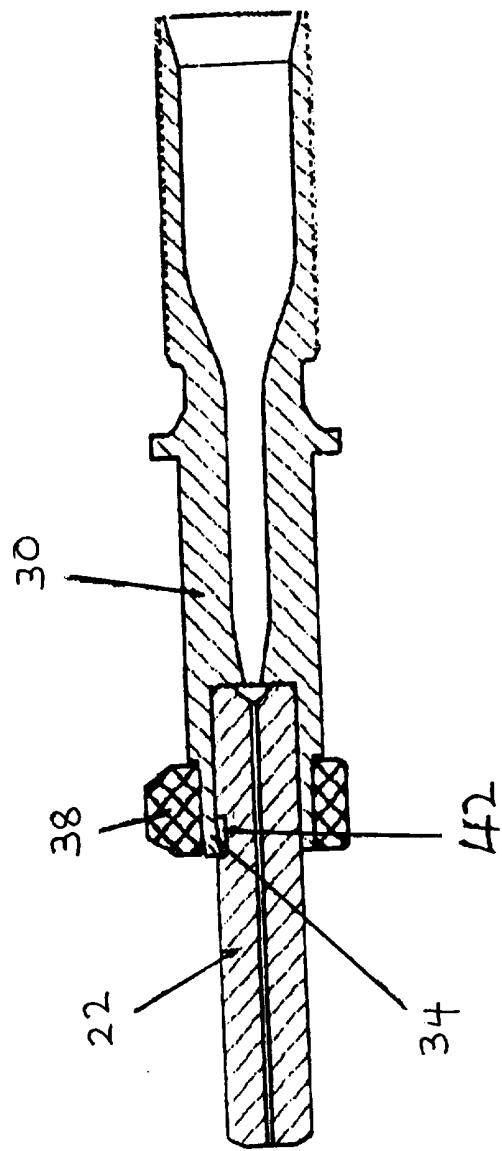


FIG. 5

OPTICAL FIBRE CONNECTOR FERRULE HOLDER

This invention relates to a ferrule holder of an optical fibre connector and more particularly to such a holder in which a ferrule can be clamped.

A standard STII type of optical fibre connector which is known to us and which is illustrated and described in more detail in connection with Figure 1 employs ferrule holder in which a ceramic ferrule is secured by bonding. Such an arrangement is costly and inconvenient in assembly and there is a substantial risk of adhesive getting onto the rear face of the ferrule and obstructing the entry for an optical fibre. Another method for mounting a ceramic ferrule into a ferrule holder known to us is by means of a press fit, but this method is unsuitable when used with diecast materials due to the different thermal expansion rates of zinc and ceramic, and the large difference in hardness of the materials. The present invention seeks to provide a construction which obviates these problems.

According to the invention there is provided an optical fibre connector ferrule holder comprising an elongate tubular body one end of which has a plurality of coaxially extending tines arranged to permit the insertion of a ferrule therebetween and an annular or part annular compression element which is a force fit over the tines thereby to effect clamping of the ferrule between the tines. It will be appreciated that securement of the ferrule by a clamping arrangement avoids any need for adhesive.

The body may be formed of metal, e.g. diecast aluminium, or a plastics material and the compression element is formed preferably from a material having a lower coefficient of expansion than that of the body. The 5 compression element may be in the form of a split ring and/or may have an inside surface which is tapered to facilitate fitting over the tines.

The front of the tines may be chamfered to facilitate fitting of the compression element thereon.

10 A further problem with the standard STII type of optical fibre connector previously referred to is that the body of the ferrule holder and a compression spring therefor is secured in a tubular housing, sometimes termed a coupling nut, by means of a circlip. This is not a convenient 15 technique for securement because there is a risk of mislocation of the circlip, which cannot be seen once assembled, and this can lead to failure in use. A refinement of the invention seeks to provide an optical fibre connector which overcomes this problem.

20 In the refinement of the invention the body of the ferrule holder is provided with an outwardly extending projection situated between opposite ends which cooperates with an inwardly extending abutment provided in the tubular housing for limiting the extension of the ferrule holder 25 therethrough, a compression spring is mountable on the body to the opposite side of the abutment and is retainable thereon in a biased state by the compression element when the compression element is force fitted over the tines.

In order that the invention and its various other preferred features may be understood more easily, an existing construction known to us and some embodiments of the invention will now be described, by way of example only, 5 with reference to the drawings, in which:-

Figure 1 is a longitudinal cross sectional view of an optical fibre connector of a type known to us,

Figure 2 is a longitudinal cross sectional view of an optical fibre connector employing a ferrule holder 10 constructed in accordance with the invention,

Figure 3 is a longitudinal cross sectional view of the ferrule holder employed in the connector of Figure 2 shown to an enlarged scale,

Figure 4 is a ferrule end view of the connector of 15 Figure 2, and

Figure 5 is a longitudinal cross sectional view of an optical fibre connector similar to that of Figure 2 employing a ferrule holder with a modified ferrule and constructed in accordance with the invention.

20 In the drawings the same reference numerals will be given to similar or identical elements.

Referring now to Figure 1 an optical fibre connector comprises a tubular housing 10, sometimes called a coupling nut, which is provided with an inwardly projecting annular 25 flange 12 between opposite ends. A tubular ferrule holder 14 of outer diameter less than the inner diameter of the housing 10 has at one end, the left hand end as illustrated, an outwardly extending radial flange 16 which defines an

abutment for a compression spring 18. At the same end of the ferrule holder 14 the bore has an enlarged portion 20 into which a ferrule 22 is inserted and retained by an adhesive. The ferrule holder 14 is provided on its outer 5 periphery at a position intermediate of its ends with an annular groove 24 for receiving a circlip 26. The ferrule holder 14 with the secured ferrule is mounted in the housing 10 as follows. The spring 18 is first slid over the ferrule holder from the right hand end, as illustrated, until it 10 abuts the flange 16. The right hand end of the ferrule holder is then inserted into the left hand end of the housing 10 through the flange 12 until it projects from the right hand end of the housing and the spring is compressed such that the groove 24 is accessible beyond the right hand 15 end of the housing. The circlip 26 is inserted into the retaining groove 24 and the ferrule holder is allowed to be urged by the spring 18 towards the left hand end of the housing until the circlip abuts the flange 12 whereupon the ferrule holder is retained in the housing with the spring 20 biasing it towards the left hand side. The spring biasing permits both axial and a small amount of lateral displacement which facilitates mating and alignment with a cooperating connector. Major disadvantages with this connector are that it is a time consuming and costly 25 operation to bond the ceramic ferrule to the holder, there is a risk of adhesive getting onto the rear face of the ferrule and miss assembly of the circlip can result in failure of the connector in use.

Referring now to the drawings of Figures 2 to 4 there is shown a ferrule holder and a connector incorporating the ferrule holder constructed in accordance with the invention which does not have the disadvantages of the Figure 1 construction. It will be seen from the diagram of Figure 2 that the housing or coupling nut 10 is identical with that of Figure 1. However, the ferrule holder 30 does not have a flange at its left hand end, as illustrated, but is provided with longitudinally extending slots 32 defining four coaxially extending tines 34 which have an externally chamfered end 36. A ferrule 22 is insertable in the left hand end between the tines and is secured therebetween by means of a compression element in the form of a ring 38 which is a force fit over the tines and which urges the tines inwardly to clamp the ferrule. The ferrule holder is provided with an outwardly projecting annular flange 40 in place of the circlip groove and this forms a projection for engagement with an abutment formed by the flange 12 of the housing. The assembly of the components is effected from the opposite end of the housing 10 from that of the construction of Figure 1, the right hand side as illustrated. The tine end of the ferrule holder 30 is inserted into the left hand end of the housing 10 through the flange 12 until the flanges 40 and 12 mutually abut. The spring is slid onto the body of the ferrule holder until it abuts the flange 12, the ceramic ferrule 22 is inserted into the ferrule holder between the tines and the ring is force fitted over the tines to urge them inwardly to clamp

or grip the ferrule therebetween and to bias the spring, which is held under slight compression, between the ring 38 and the flange 12. By virtue of the interference fit of the ring on the tines it is retained on the ferrule holder.

5 The ferrule holder and housing described may be made of any suitable material e.g. metal, such as die cast aluminium, or a plastics material.

Although the illustrated embodiment employs four tines 34 it will be appreciated that two or any number more 10 than two tines may be provided.

Whilst the compression element of the described embodiment is a continuous ring, a split ring may be employed and this may be of a resilient spring like material. Furthermore, the compression element may be part 15 of a ring. The compression element or ring may have an inside surface which is tapered or chamfered to facilitate fitting over the tines in which case the end of the tines need not be chamfered.

The ring is preferably constructed of a material 20 having a lower coefficient of expansion than that of the ferrule holder so that the clamping action of the tines on the ferrule is enhanced rather than relaxed with increasing temperature.

25 The compression element and the tines or body of the ferrule holder may be provided with one or more cooperating projections and recesses which provide for snap engagement when the compression element is fully located over the tines.

Figure 5 illustrates a refinement of the invention which enhances the resistance to withdrawal of the ferrule when the compression element is force fitted over the tines. In this embodiment the ferrule is provided with a recess 42 which aligns with the end of the tines when the ferrule is fully inserted. When the compression element (ring 38) is forced over the tines it causes the end of a tine to be forced into the recess. This engagement with the recess further enhances the resistance to withdrawal of the ferrule and is of particular value during fixing of the fibre in the ferrule with an epoxy resin material as temperatures of 200°C are encountered during curing of the resin.

It will be appreciated that there are other ways of providing mutual inter engagement between the ferrule and one or more of the tines. For example the recess 42 may be annular permitting engagement of the ends of each of the tines. Alternatively the ferrule may be provided with a projection which engages a recess in one of the tines. The projection may be in the form of an annular flange which engages a recess in each of the tines. Each of these constructions is considered to fall within the scope of this invention.

CLAIMS:

1. An optical fibre connector ferrule holder comprising an elongate tubular body one end of which has a plurality of coaxially extending tines arranged to permit 5 the insertion of a ferrule therebetween and an annular or part annular compression element which is a force fit over the tines thereby to effect clamping of the ferrule between the tines.
2. A ferrule holder as claimed in claim 1, wherein 10 the body is formed from a metal.
3. A ferrule holder as claimed in claim 1, wherein the body is formed from a plastics material.
4. A ferrule holder as claimed in claim 1, 2 or 3, wherein the compression element is formed from a material 15 having a lower coefficient of thermal expansion than that of the body.
5. A ferrule holder as claimed in any one of the preceding claims, wherein the compression element is a split spring ring.
- 20 6. A ferrule holder as claimed in any one of the preceding claims wherein the front of the tines are chamfered to facilitate fitting of the compression element thereover.
7. A ferrule holder as claimed in any one of the 25 preceding claims, wherein the inside surface of the compression element is tapered to facilitate fitting over the tines.
8. A ferrule holder as claimed in any one of the

preceding claims, comprising mutually engageable locking elements provided on the compression element and on the tines or elongate body to permit snap location of the compression element.

5 9. A ferrule holder as claimed in any one of the preceding claims, wherein the body is provided with an outwardly extending projection situated between opposite ends for cooperation with an abutment of a coupling housing of an optical fibre connector.

10 10. A ferrule holder as claimed in claim 9, wherein the outwardly extending projection is an annular flange.

11. An optical fibre ferrule holder substantially as described herein with reference to, and as illustrated in, Figure 3 of the drawings.

15 12. An optical fibre ferrule holder as claimed in any one of the preceding claims in combination with a ferrule, wherein the ferrule is provided with a formation which is engageable by a portion of at least one of the tines to enhance resistance to withdrawal of the ferrule in 20 the clamped state.

13. A ferrule and holder combination as claimed in claim 12, wherein the formation is a recess into which the extremity of one of the tines is caused to locate upon force fitting of the compression element.

25 14. A ferrule and holder combination as claimed in claim 12, wherein the formation is a projection which engages a recess in at least one of the tines.

15. A ferrule and holder combination as claimed in

claim 12, wherein the ferrule and at least one of the tines are provided with a cooperating projection and recess which are mutually engaged to enhance resistance to withdrawal of the tine in the clamped state.

5 16. A ferrule and holder combination substantially as described herein with reference to Figure 5 of the drawings.

10 17. An optical fibre connector comprising a ferrule holder as claimed in claim 9 or 10 and a tubular housing therefore having an inwardly extending abutment therein against which the outwardly extending projection abuts to limit the extension of the ferrule holder therethrough and compression spring means mountable on the body to the opposite side of the abutment and retainable thereon in a 15 biased state by the compression element when the compression element is force fitted over the tines.

18. An optical fibre connector as claimed in claim 17, wherein the inwardly extending abutment is an annular flange.

20 19. An optical fibre connector as claimed in claim 17 or 18, including a ferrule for receiving an optical fibre which ferrule is located in the body between the tines against a stop and secured therein by the compression element force fitted onto the tines.

25 20. An optical fibre connector as claimed in claim 19, wherein the ferrule is formed from a ceramic material.

21. An optical fibre connector substantially as described herein with reference to, and as illustrated in,

Figure 2 or 5 of the drawings.

Relevant Technical Fields		Search Examiner MR C J ROSS
(i) UK Cl (Ed.M)	G2J (JGEA)	
(ii) Int Cl (Ed.5)	GO2B	Date of completion of Search 16 SEPTEMBER 1994
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE DATABASES: WPI		Documents considered relevant following a search in respect of Claims :- 1-21

Categories of documents

- K:** Document indicating lack of novelty or of inventive step.
P: Document published on or after the declared priority date but before the filing date of the present application.
Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.
E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A: Document indicating technological background and/or state of the art.
&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	WO 92/19998 A1	(I.T.T.) see especially lines 80-84, ferrule 40	1 at least

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).