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(58) Field of search
G2J
Selected US specifications from IPC sub-class G02J

(54) Optical fibre units

(57) An optical fibre unit comprises a plurality of optical fibres 1, each with a protective coating 3, bonded together to form a flexible assembly for example by impregnating the interstices with wax or a thermoplastics material 2, or alternatively by lashings in the form of a filament or tape wound helically around the fibres. The element may further comprise a flexible strength element 4 or may be formed in a ribbon shape (Figure 4) or stack (Figure 5). Each unit may then be housed in a cable structure, Figures 7 and 8.

Fig. 3.

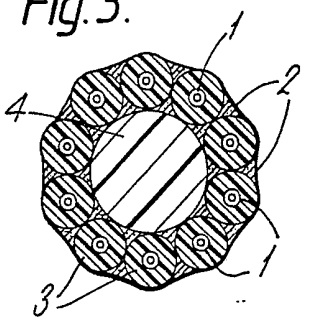

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Fig.1.

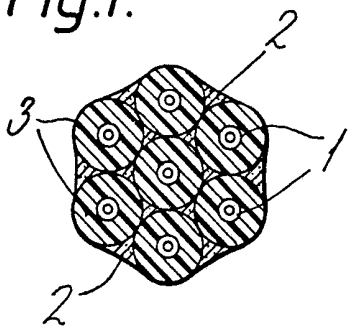


Fig.2.

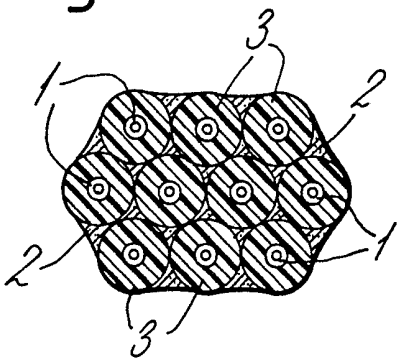


Fig.3.

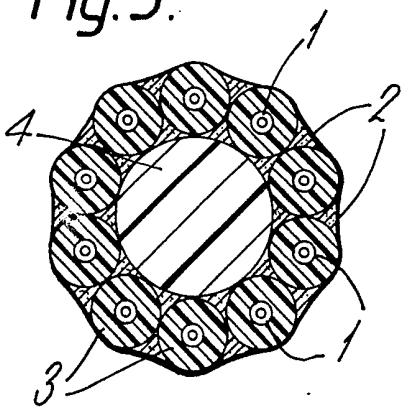


Fig.4.

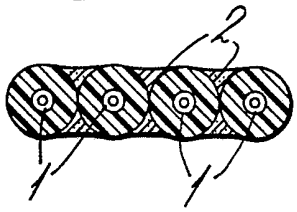


Fig.5.

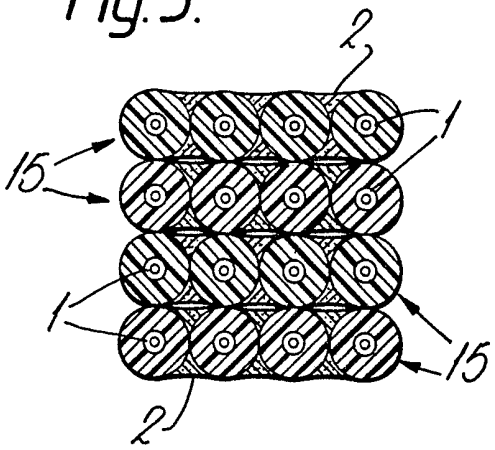


Fig.6.

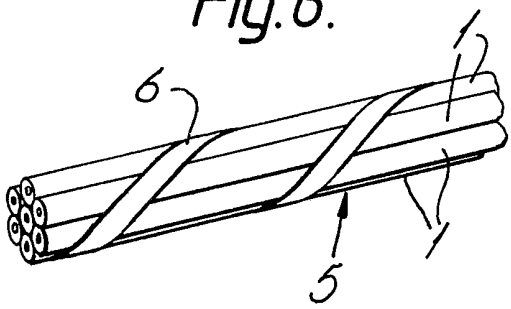


Fig.7.

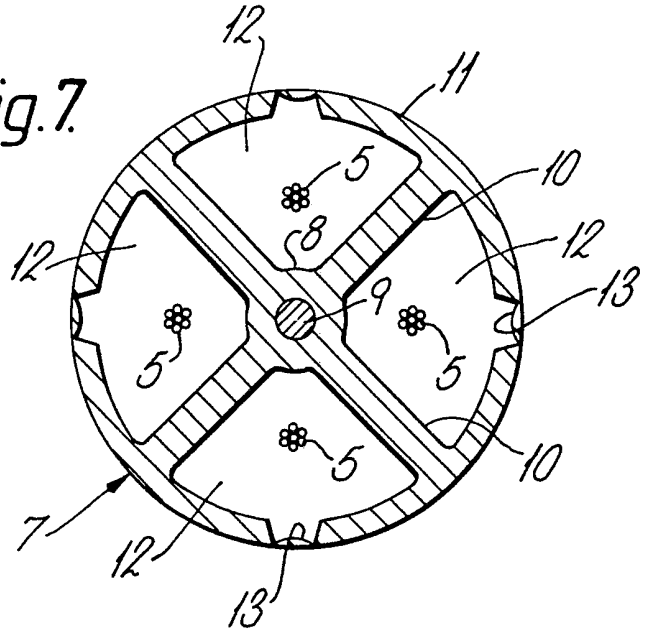
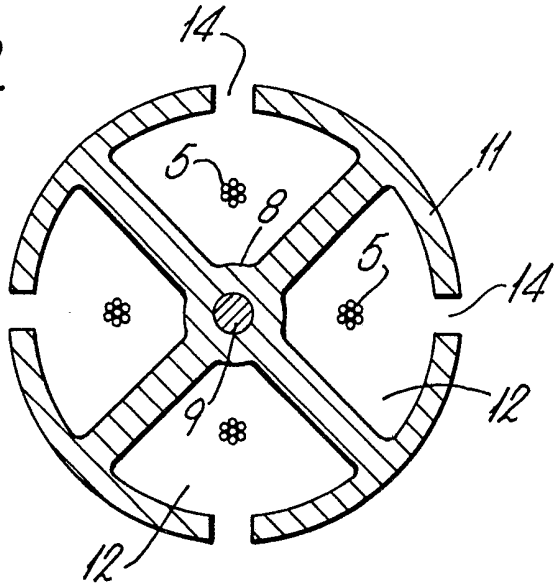


Fig.8.



SPECIFICATION

Optical fibre units

This invention relates to optical fibre units and to optical fibre cables incorporating such units. Optical fibres at present produced are usually provided with a protective coating, for example of synthetic resin, commonly called a primary coating.

According to one aspect of the invention an optical fibre unit comprises a plurality of optical fibres each with a primary coating, and the coated fibres are bonded together to form a compact flexible assembly.

The fibres may be bonded together by impregnating the interstices between the fibres with a thermoplastics material, for example an EVA type plastic, or a wax, which adheres to the fibre coatings. The bonding material should, of course, have a melting point sufficiently high to be retained within the fibre interstices during any subsequent processing of the optical fibre assembly, for example on the application of an extruded thermoplastic sheath around the fibre unit during manufacture of an optical fibre cable incorporating the fibres. A microcrystalline wax having a melting point of the order of 80°C has been found particularly suitable for this purpose. The use of such a substance as the bonding material is especially advantageous as it enables the ends of the fibres to be readily separated when required, which may sometimes be necessary, for example, for connection to other fibres.

The fibres may be bonded together in the form of a bundle, and in such a case they may be alternatively secured to each other by one or more lashings wound helically around the fibre bundle. The or each lashing, which may be in the form of a filament or tape, is preferably secured to the fibre bundle by a suitable adhesive. In this case a lubricating material may be provided between the fibres.

The fibres forming the bundle may extend parallel to the bundle axis or may be disposed in a helical or periodically reversing helical fashion about the bundle axis.

In some cases they may be disposed, preferably uniformly, around a central flexible filament of larger diameter, for example of nylon. This gives a more stable arrangement, with improved flexibility and also reduces the likelihood of the fibres themselves being subjected to tensile stress.

However the fibres may in some cases be bonded together in the form of a ribbon, preferably by means of a wax, and a plurality of such ribbons may be superposed on top of each other to form a stack. The individual ribbons may also be bonded together by means of a wax if desired.

Several different embodiments of the invention will now be described by way of example with reference to Figures 1 to 8 of the accompanying schematic drawings, in which

Figures 1 to *5* represent cross sections through three different forms of optical fibre unit in accordance with the invention,

Figure 6 illustrates a side view of an alternative form of optical fibre unit, and

Figures 7 and *8* represent two different forms of optical fibre cable suitable for incorporating optical fibre units in accordance with the invention.

Thus, referring first to Figure 1, the optical fibre unit illustrated comprises seven optical fibres 1 having a primary resin coating and arranged in a compact bundle, the fibres being bonded together by means of a microcrystalline wax 2 such as that sold by CERESE Ltd with a melting point of about 78° to 80°C, the wax being impregnated into the interstices between the fibres, and being sufficiently adhesive to secure the fibres together, but enabling the ends of the fibres to be readily separated when desired, for example for coupling to other fibres. The resin coatings 3 of the fibres are preferably differently coloured for identification purposes. In place of the wax 2, a thermoplastics material, such as an EVA type plastics, could alternatively be impregnated into the interstices of the fibres so as to provide the bonding medium. Another bonding medium which could be used is a U.V. curable resin.

An alternative form of optical fibre unit, this time incorporating ten optical fibres 1 formed into a bundle is illustrated in Figure 2, the fibres being bonded together by a suitable bonding medium as at 2 which could be any of the materials utilised to secure the fibres of the first unit.

Figure 3 represents a cross section of the third unit, also comprising ten optical fibres 1, the fibres in this case being grouped around a central flexible filament 4, for example of nylon, of approximately twice the diameter of the fibres, the fibres again being bonded to each other, and additionally to the central filament as at 2 by a suitable bonding medium, for example as previously mentioned.

Figure 4 represents a cross section of an alternative form of optical fibre unit incorporating four resin-coated optical fibres 1 disposed side by side and bonded together by means of a microcrystalline wax 2 to form a flat ribbon-like assembly.

Several such ribbons 15, for example four as shown in Figure 5, may be stacked one on top of the other and lightly secured together, for example also by means of wax, to form a 4×4 array.

However different numbers of ribbons may be stacked together, and ribbons having a similar construction to that illustrated in Figure 5, may incorporate different numbers of fibres.

The unit illustrated in Figure 6 comprises the required number of resin-coated fibres 1, in this case seven, grouped together to form a compact bundle 5, and bonded together by means of a helically wound lashing 6 of Kevlar or other suitable material. The lashing 6 is conveniently bonded to fibres 1 by an adhesive substance, and may be in the form of a self-adhesive tape. By bonding the lashing to the fibres unravelling of the lashing when the fibres are cut is effectively prevented.

One cable accommodating a plurality of optical fibre units as described with reference to any one of Figures 1 to 6 is illustrated in Figure 7, the cable comprising an extrusion 7 of thermoplastics material having a central core portion 8 surrounding a central strength member 9, four radially extending fins 10 and an outer cover 11, the core, fins and cover being

integral with each other and defining between them four longitudinally extending channels 12. Previously formed optical fibre units 5, which may be constructed as illustrated in any one of Figures 1 to 6, are introduced into the channels 12 during the extrusion process; where the bonding medium is wax or thermoplastics material it will be appreciated that its melting point must be sufficiently high to ensure that it is retained within the interstices between the fibres 1 during the extrusion process. The fibre units 5 are conveniently fed into the channels 12 at a rate faster than the rate at which the extrusion 7 is formed so that they follow an undulating path and are loosely accommodated within their respective channels 12. Each channel 12 may be formed, as shown at 13, with a region extending along the cable which is of thinner cross section than the remainder of the wall, enabling it to be more easily cut, broken or pulled away to provide access to a fibre unit 5 within the channel if this is required.

The cable illustrated in Figure 8 has a similar construction to that of Figure 5, except that the thinned portions 13 of the outer cover 11 are replaced by longitudinally extending slots 14. These slots permit the fibre units 5 to be introduced after the extrusion process and also provide ready access to them. In a modification, not shown, each said slot may be covered by an openable flap.

Although in each of Figures 7 and 8 only one fibre unit 5 is shown in each of the channels 12, in practice several units may be accommodated in the channels if desired. It will be appreciated that the extruded assembly with the fibre units contained within it may be surrounded by one or more outer sheaths, which may also be of extruded plastics material possibly incorporating a moisture barrier of plastics coated metal foil.

A water-blocking and/or hydrogen trapping material, preferably in powder form may be included within each of the channels if desired.

It will also be appreciated that the fibre units in accordance with the invention can be accommodated in other forms of cable structures.

CLAIMS

1. An optical fibre unit comprising a plurality of optical fibres each with a primary coating, wherein the coated fibres are bonded together to form a compact flexible assembly.

2. An optical fibre unit according to Claim 1 wherein the fibres are bonded together by a thermoplastics material which adheres to the fibre coatings.

3. An optical fibre unit according to Claim 1 wherein the fibres are bonded together by a wax which adheres to the fibre coatings.

4. An optical fibre unit according to Claim 2 wherein the thermoplastics material is an EVA type plastic.

5. An optical fibre unit according to Claim 3 wherein the bonding material is a microcrystalline wax having a melting point of the order of 80°C.

6. An optical fibre unit according to Claim 1 wherein the fibres are bonded together by one or more lashings wound helically around the assembled fibres.

7. An optical fibre unit according to Claim 6 wherein the or each lashing is secured to the fibre assembly by an adhesive.

8. An optical fibre unit according to Claim 6 or 7 wherein the or each lashing is in the form of a filament or tape.

9. An optical fibre unit according to any of Claims 6 to 8 wherein a lubricating material is provided between the fibres.

10. An optical fibre unit according to any of Claims 1 to 9 wherein the fibres extend parallel to the axis of the unit.

11. An optical fibre unit according to any of Claims 1 to 9 wherein the fibres are disposed in a helical or periodically reversing helical fashion about the axis of the unit.

12. An optical fibre unit according to Claim 11 wherein the fibres are disposed around a central flexible filament of larger diameter.

13. An optical fibre unit according to Claim 12 wherein the fibres are disposed uniformly around the central filament.

14. An optical fibre unit according to Claim 12 or 13 wherein the central filament is composed of nylon.

15. An optical fibre unit according to Claim 1, 3 or 5 in which the fibres are bonded together side by side in the form of a ribbon.

16. An optical fibre unit according to Claim 15 wherein a plurality of said ribbons are superposed on each other to form a stack.

17. An optical fibre unit according to Claim 16 wherein the ribbons are bonded together.

18. An optical fibre unit substantially as hereinbefore described with reference to any one of Figures 1 to 6 of the accompanying drawings.

19. An optical cable incorporating one or more optical fibre units according to any preceding Claim.

20. An optical cable according to Claim 19 constructed substantially as shown in and as hereinbefore described with reference to Figure 7 or 8 of the accompanying drawings.

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