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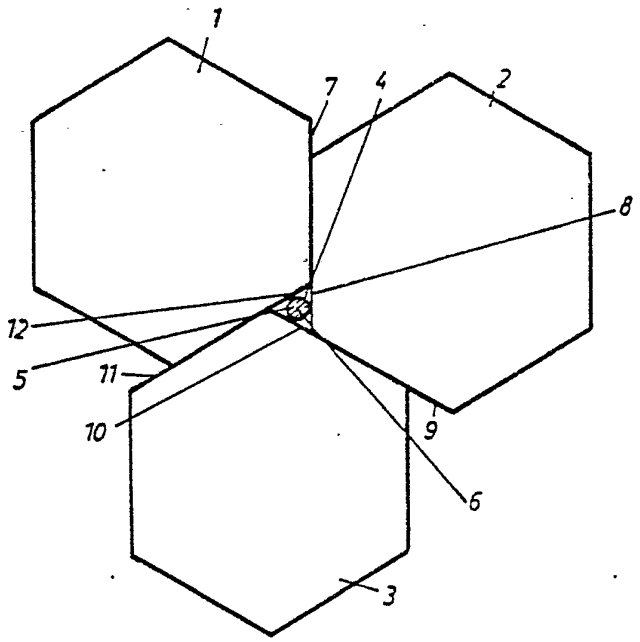
(54) Title: APPARATUS FOR MUTUALLY ALIGNING THE ENDS OF TWO OPTICAL FIBRES THAT ARE TO BE CONNECTED

(57) Abstract

The apparatus comprises at least three parallel rods (1, 2, 3) adapted to form between themselves a channel (4) for accommodating the ends of the two fibres, and means for keeping the rods together and clamping the fibre ends in the channel between the rods. In accordance with the invention, each rod (1, 2, 3) has two plane surfaces (7, 12; 8, 9; 10, 11) intersecting along a longitudinal edge. One of these plane surfaces on the respective rods bears against one of these plane surfaces on an adjacent rod such that said longitudinal edges of the rods extend parallel to, and are distributed round a longitudinal axis of symmetry (6). The rods are further mutually displaceable relative to the axis of symmetry (6) by sliding between the plane surfaces bearing against each other to form the channel (4) for accommodating the fibre ends.



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APPARATUS FOR MUTUALLY ALIGNING THE ENDS OF TWO OPTICAL FIBRES THAT ARE TO BE CONNECTED

TECHNICAL FIELD

The present invention relates to an apparatus for mutually aligning the ends of two optical fibres which are to be connected, comprising at least three parallel rods adapted to form between themselves a channel for accommodating the ends of the two fibres, and means for keeping the rods together and clamping the fibre ends in the channel between the rods.

BACKGROUND ART

It is known to align two optical fibres with the aid of three cylindrical rods, for example, which between themselves form a channel, from either end of which the respective fibre end is inserted. Accurate alignment is obtained only when the rods bear against each other to form the channel. This means that rods of different diameters are required for different fibre diameters.

In DE-OS 2917679 there is proposed an aligning apparatus with three rods, with which fibres of different diameters can be aligned by having the rods provided with a plane surface and made rotatable to form a channel with variable opening area between the plane surfaces of the rods. The design of this aligning apparatus is complicated, however, which makes it expensive and difficult to manufacture.

DISCLOSURE OF INVENTION

The object of the present invention is to bring about an aligning apparatus for aligning optical fibres of different diameters, which apparatus is simple and cheap to manufacture.

This object is achieved by the aligning apparatus in accordance with the invention having been given the characterizing features disclosed in the claims.

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BRIEF DESCRIPTION OF DRAWING

The invention will now be described in detail below with reference to the accompanying drawing, on which Figure 1 is an end view of a first embodiment of the aligning apparatus in accordance with the invention, and Figure 2 is an end view of a second embodiment of said apparatus.

BEST MODES FOR CARRYING OUT THE INVENTION

Figure 1 schematically illustrates an end view of a first embodiment of the aligning apparatus in accordance with the invention. This embodiment includes three hexagonal rods 1, 2 and 3 of metal, glass, plastics or the like. The rods extend mutually parallel and are placed upon each other such that they between themselves form a channel 4 for accommodating the ends of two fibres which are to be connected, one of said fibres being shown in section and denoted by the numeral 5. For bringing the rods in the right position relative to each other and to facilitate the insertion of the fibres between the rods, a rod-like member with circular section can be inserted beforehand between the rods, said member being removed in conjunction with the insertion of one of the fibres between the rods. The rods 1, 2 and 3 are kept together by an unillustrated elastic means, e g a number of rubber O-rings.

In accordance with the invention, each rod shall have two plane surfaces intersecting along a longitudinal edge, and the rods shall be so laid upon each other that one of the plane surfaces of each rod bears against one of the plane surfaces of an adjacent rod, such that said longitudinal edges of the rods along which said two plane surfaces intersect extend parallel to, and are distributed round a longitudinal axis of symmetry 6.

In the case with three rods according to Figure 1, the plane surface 7 of rod 1 bears against the plane surface 8 of rod 2, while the plane surface 9 of rod 2 bears against the plane surface 10 of rod 3, and the plane surface 11 of rod 3 bears against the plane surface 12 of rod 1. The rods 1, 2 and 3 are mutually displaceable relative to the axis of symmetry 6 by sliding between the plane surfaces that bear against each other to form the channel 4 for the fibre ends. The means for displacing the rods relative to the axis of symmetry 6 are not

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part of the invention and are therefore not illustrated on the drawing.

From an initial position, in which the rods 1, 2 and 3 either are completely brought together so that the opening area of the channel 4 is practically zero, or are displaced a predetermined distance relative to each other to be able to accommodate fibres up to a predetermined diameter in the channel, e g with the aid of the aforementioned rod-like member, the rods can be displaced into engagement with their plane surfaces 8, 10 and 12, respectively, against the fibres inserted into the channel 4.

Upon splicing the fibres the fibre ends must be cut off uniformly and square and be provided with cement or a refractive index-matching liquid before they are brought together in the channel 4. The rods can then be clamped together with the aid of an unillustrated clamping means for locking the fibres in the channel 4 between the rods 1, 2 and 3. The clamping means may consist of e g a key joint. To provide this, the rods are tapered towards both ends and unillustrated sleeves with tapered central holes are threaded onto the respective ends of the rod bundle, and displaced towards each other for clamping the rods in a direction towards the axis of symmetry 6. The sleeves suitably comprise the same material as the rods. By an unillustrated orifice through one of the rods 1, 2 and 3, directed towards the axis of symmetry 6, a welding means can also be inserted for welding the fibre ends inserted into the channel 4.

An embodiment of the aligning apparatus in accordance with the invention, having four rods 13, 14, 15 and 16 of square section, is illustrated in Figure 2. The two plane surfaces of the rods that are intended to bear against one of the plane surfaces of each adjacent rod, intersect at an angle of 90^{o} and consequently the cross section of the channel 4 formed between the rods will be square. In this case as well, the aligning apparatus is assumed to be provided with unillustrated means for keeping the rods 13, 14, 15 and 16 together, and clamping the fibre ends in the channel 4 between the rods.

In the embodiments illustrated in Figures 1 and 2, the angles are the same between the two surfaces of the respective rod, that are intended to bear against a corresponding surface of the adjacent rods. In the case of four rods, the angles between these surfaces on all rods do not however need to be the

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same, but may be the same in pairs, the cross-sectional shape of the channel then being rhombic.

It is of course also possible to use five or more rods. The essential thing is that the sum of the angles disposed around the axis of symmetry 6 in the position when the rods are brought together, is 360^{o}.

With the aligning apparatus in accordance with the invention it is thus possible to align fibres of different diameters. By the rod surfaces bearing against each other the whole time a very good aligning accuracy is obtained.

By making at least one of the rods of a transparent material, e g glass, the splicing or connecting operation can be supervised visually. In the embodiment according to Figure 2, the rods can be made from magnetic material and can be magnetized such that they are kept together in order to further facilitate the connecting operation.

Apparatuses of this kind can be made such that they enable alignment of several fibres at the same time. By adding three further rods to the embodiment illustrated in Figure 1, an apparatus for simultaneously aligning four fibres will be obtained, the number of rods per fibre thus being reduced.

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CLAIMS

1 Apparatus for mutually aligning the ends of two optical fibres (5) which are to be connected, comprising at least three parallel rods (1, 2, 3) adapted to form between themselves a channel (4) for accommodating the ends of the two fibres (5), and means for keeping the rods (1, 2, 3) together and clamping the fibre ends in the channel between the rods, characterized in that each rod (1, 2, 3) has two plane surfaces (7, 12; 8, 9; 10, 11) intersecting along a longitudinal edge, that one of said plane surfaces of each rod bears against one of said plane surfaces of an adjacent rod such that said longitudinal edges extend parallel to, and are distributed round a longitudinal axis of symmetry (6), and that the rods (1, 2, 3) are mutually displaceable relative to the axis of symmetry (6) by sliding between the plane surfaces bearing against each other to form the channel (4).

2 Apparatus as claimed in claim 1, characterized in that the angles between the two plane surfaces of the respective rods are the same on each rod.

3 Apparatus as claimed in claim 1, characterized in that the angles between the two plane surfaces of the respective rods are the same in pairs.

4 Apparatus as claimed in any of claims 1-3, characterized in that the rods (1, 2, 3) are tapered towards their ends, and that sleeves with tapered central holes are threaded over the ends of the rods bearing against each other, said sleeves being displaceable in a direction towards each other for clamping the rods together in a direction towards the axis of symmetry (6).

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Fig. 1

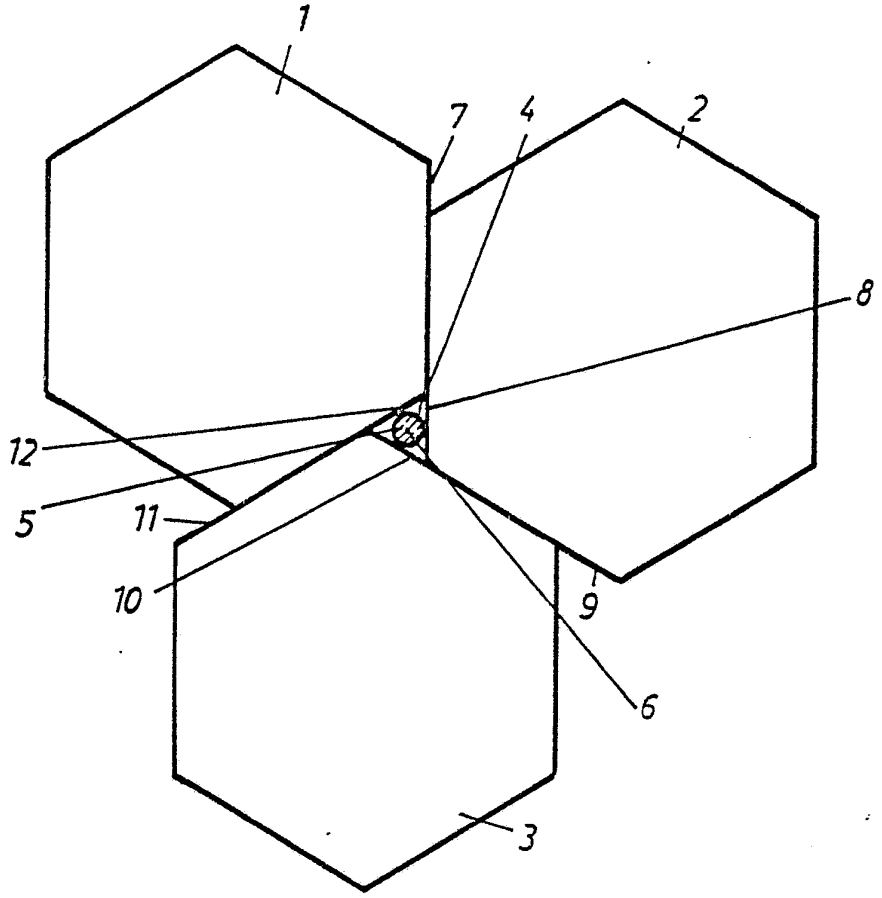
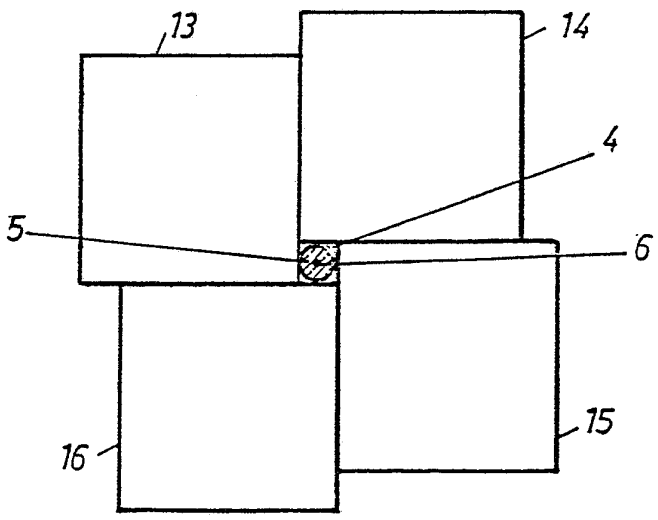


Fig. 2



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INTERNATIONAL SEARCH REPORT

International Application No PCT/SE83/00207

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC 3

G 02 B 7/26

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC 3	G 02 B 5/14, 7/26
US Cl	350: 96, 96.15, 96.20, 96.21, 96.22

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
A	SE, A , 7903805-5 (NV PHILIPS' GLOEILAMPEN-FABRIEKEN) 6 November 1979 & DE, A1, 2 917 679	1-4
A	DE, B2, 2 757 216 (WESTERN ELECTRIC CO INC) 6 July 1978	1-4
A	DK, B , 143 620 (COMPAGNIE GENERALE D'ELEC-TRICITE) 21 December 1975	1-4
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IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
1983-08-05	1983 -08- 16
International Searching Authority [1]	**Signature of Authorized Officer [20]**
Swedish Patent Office	Monica Eurenius