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(71) Applicant *(for all designated States except MG US)*: N.V. RAYCHEM S.A. [BE/BE]; Diestsesteenweg 692, B-3010 Kessel-Lo (BE).

(71) Applicant *(for MG only)*: RAYCHEM LIMITED [GB/GB]; Faraday Road, Dorcan, Swindon, Wiltshire SN3 5HH (GB).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: DAEMS, Daniel [BE/BE]; De Dreef Van Zonnebos 10, B-2970 'S-Gravenwezel (BE). MACKEN, Luk [BE/BE]; Kortrijksestraat 20, B-3010 Kessel-Lo (BE). GRAULUS, Hendrik [BE/BE]; Groenstraat 69, B-3020 Veltem-Beisem (BE).

(74) Agents: CLAYTON, Anthony, Nicholas et al.; Raychem Limited, Intellectual Property Law Dept., Faraday Road, Dorcan, Swindon, Wiltshire SN3 5HH (GB).

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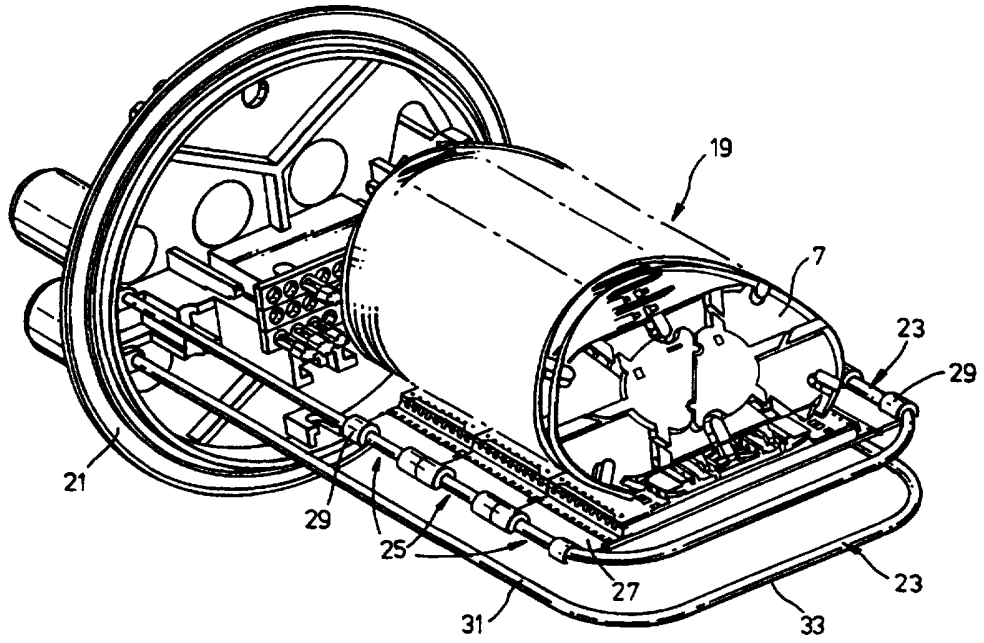

(57) Abstract

A kit of parts for forming an optical fibre organizer is disclosed. The kit comprises at least two different modules selected from: (i) a storage module comprising a support plate supporting at least one optical fibre storage means; (ii) a breakout module comprising a support plate supporting at least one optical fibre breakout means; and (iii) a guide module comprising a support plate supporting a plurality of projections between which optical fibres may be guided. Each module is attachable either directly or indirectly to each other module such that their support plates are arranged side-by-side and thereby together form a larger support plate. The organizer may be housed in an optical fibre cable splice closure.

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OPTICAL FIBRE ORGANIZER

The present invention relates to the organization of optical fibres, e.g. in an optical fibre cable splice closure.

Many different designs of optical fibre organizer are known. For example, WO 95/07480 (Raychem) discloses a base for an optical fibre organizer, which comprises: a first passage along one longitudinal edge portion for incoming fibres; a second passage along an opposite longitudinal edge portion for outgoing fibres; a plurality of first fibre guides separated from one another along the length of the base and extending from the first passage across the base towards the second passage where fibres in said guides are directed away from the plane of the base; and a plurality of second fibre guides separated from one another along the length of the base and extending from the second passage across the base towards the first passage where fibres in said guides are directed away from the plane of the base.

WO 95/07475 (British Telecom) discloses an optical fibre management system comprises a plurality of splice trays arranged in a stack. Each splice tray has a main body portion for holding at least one splice, and for storing fibres leading to the splice(s), and a fibre entry/exit portion for feeding fibre to/from the main body portion. Each tray is mounted in the stack so as to be movable from a stacked position, in which it is aligned with the other trays, to first and second operating positions in which the fibre entry/exit portion and the main body portion respectively are accessible.

WO 95/25978 (Raychem) discloses an apparatus for arranging a plurality of stacks of optical fibre splice organizers in a closure, comprising a frame and at least two optical fibre splice organizer supports located on the frame, each organizer support being arranged to support a stack of organizers. The frame may be elongate

and the organizer supports may each support a stack of organizers which extends laterally with respect to the frame. The organizer supports may be in one or more pairs, the supports of each pair being arranged back-to-back.

According to a first aspect, the invention provides a kit of parts for forming an optical fibre organizer, comprising at least two different modules selected from the following different modules:

(i) a storage module comprising a support plate supporting at least one optical fibre storage means;
(ii) a breakout module comprising a support plate supporting at least one optical fibre breakout means; and
(iii) a guide module comprising a support plate supporting a plurality of projections between which optical fibres may be guided;

whereby each module is attachable either directly or indirectly to each other module such that their support plates are arranged side-by-side and thereby together form a larger support plate.

Preferably, the kit further comprises a support to which each module may be attached. By attachment of each module to the support, indirect attachment of each module to the or each other module results.

According to a second aspect, the invention provides a kit of parts for forming an optical fibre organizer, comprising:

(a) a support; and
(b) at least two different modules selected from the following different modules:
    (i) a storage module comprising a support plate supporting at least one optical fibre storage means;

(ii) a breakout module comprising a support plate supporting at least one optical fibre breakout means;

(iii) a guide module comprising a support plate supporting a plurality of projections between which optical fibres may be guided;

whereby the modules are attachable to the support side-by-side such that their support plates together form a larger support plate.

The support preferably comprises a frame. Additionally or alternatively, the support may comprise a plurality of interconnectable parts.

Each optical fibre storage means preferably comprises a tray. By an "optical fibre storage tray" is meant any generally flat optical fibre storage means, normally having two major surfaces, which storage means stores lengths of optical fibre and preferably also stores one or more splices, splitters, connections or other optical or optoelectronic devices associated with the optical fibre(s). By "generally flat" is meant that the tray will normally be substantially larger in two of its dimensions than its third dimension. Furthermore, the tray need not have a substantially uniform thickness. Optical fibre storage trays are sometimes called "cassettes". The major surfaces of the tray may be discontinuous (e.g. having holes or in the form of a mesh or a frame), and this also includes the possibility that the "surface" is only present at edges of the tray. Advantageously, each optical fibre storage tray may be hinged with respect to the support plate which supports it. Each optical fibre storage module preferably includes a plurality of optical fibre storage trays.

According to a third aspect, the invention provides a kit of parts for forming an optical fibre organizer, comprising:

(a) a support frame; and

(b) a plurality of modules, each of which comprises a support plate supporting at least one of the following:

(i) a plurality of hinged optical fibre storage trays;

(ii) at least one optical fibre breakout means;

(iii) at least one optical fibre guide means;

whereby the modules are attachable to the support frame side-by-side such that their support plates together form a larger support plate.

In preferred embodiments of the invention, the support frame comprises at least two spaced-apart parts to which each module may be attached such that its support plate substantially spans the gap between the spaced-apart parts. Each spaced-apart part is preferably elongate in shape. Advantageously, the support frame may further comprise at least one elongate cross-member which extends between the two elongate parts.

Each module, preferably the support plate of the module, preferably includes one or more attachment devices by which it may be attached to the support. Preferably each attachment device is interlockable with the support.

Each storage module is preferably able to store at least one loop of optical fibre without bending the fibre below its critical bend radius. For example, in embodiments in which the storage module includes one or more optical fibre storage trays, each tray preferably stores at least one loop of optical fibre. The storage trays or other storage means may also store optical fibre splices, splitters or other passive or active devices.

The or each optical fibre breakout means preferably comprises a first passage for retaining a first tube carrying a plurality of optical fibres, and a plurality of second passages for retaining a plurality of second tubes each of which carries at least one optical fibre extending from the first tube. The or each optical fibre breakout module preferably includes a plurality of optical fibre breakout means.

According to a fourth aspect of the present invention, there is provided a kit of parts for forming an optical fibre organizer, comprising:

(a) one or more optical fibre storage tray(s);

(b) at least one optical fibre guide element, to which said one or more optical fibre storage tray(s) may be directly or indirectly attached, the or each guide element including one or more optical fibre guide(s) arranged to guide at least part of the length of at least one optical fibre, which length extends, in use, between the exterior of the organizer and said storage tray(s); and

(c) a base, to which a plurality of said guide elements may be directly or indirectly attached, the base comprising a frame.

According to a fifth aspect of the invention, there is provided a kit of parts for forming an optical fibre organizer, comprising:

(a) at least two optical fibre storage tray(s);

(b) at least two optical fibre guide elements, to each of which at least one said optical fibre storage tray may be directly or indirectly attached, each guide element including one or more optical fibre guide(s) arranged to guide at least part of the length of at least one optical fibre, which length extends, in use, between the exterior of the organizer and said storage tray(s);

wherein at least two said optical fibre guide elements may be directly connected together.

The optical fibre guide elements of this fifth aspect of the invention may preferably be directly connected together in a self-supporting manner. Alternatively, the kit may further comprise a base, e.g. a frame, to which the guide elements may be directly or indirectly attached. The guide elements are preferably interconnectable by means of interlocking parts and/or by means of fastening devices, e.g. screws, bolts or the like.

In this specification, the terms "support" and "base" (when used in reference to the kits and organizers of the invention) are interchangeable.

According to a sixth aspect, the invention provides an optical fibre organizer assembled from a kit according to any of the other aspects of the invention.

According to a seventh aspect, the invention provides a closure comprising a casing, and an optical fibre organizer according to the sixth aspect of the invention contained inside the casing. The closure may, for example, be a cable splice closure, or a cabinet, or a module of a distribution frame.

According to an eighth aspect, the invention provides a kit of parts for forming an optical fibre cable closure, comprising a kit according to any of the first to fifth aspects of the invention, and a casing for enclosing the optical fibre organizer. The casing (according to the seventh and eighth aspects of the invention) preferably comprises a casing base containing cable ports, and a generally dome-shaped cover attachable to the casing base, the optical fibre organizer being attachable to the casing base.

The fourth and fifth aspects of the invention have the advantage that because the optical fibre guides are provided on optical fibre guide elements which may be attached to a base and/or connected together, it is not necessary to produce a range of base plates (e.g. of the type disclosed in WO95/07480) in order to cater for the range of types, sizes and numbers (i.e. quantities), of optical fibre carriers (e.g. different sizes of tubes, or ribbons carrying different numbers of fibres) which are used today, and which may be used in the future, in optical fibre networks. Instead, a kit according to the invention, having the correct guide element or elements, or the correct mix of different guide elements, may be chosen for each network, or each application or type of application in a network. Thus the invention provides an increased level of modularity, enabling kits having the correct number(s) and/or type(s) and/or size(s) of optical fibre guides for each network or application to be provided. Additionally or alternatively, a range of types and/or sizes of optical fibre guide elements may be provided in the kit, enabling the installer to select from the kit

the correct number, size and/or type of optical fibre guides for each particular situation.

The or each optical fibre guide element in the kit may advantageously be in the form of a plate (or like generally flat structure), e.g. a support plate.

Preferably, the or each optical fibre guide element has an entrance and an exit through which, in use, one or more optical fibre(s) extend(s), respectively, into the guide, and out of the guide and into a storage tray attached directly or indirectly to the guide element. The guide exit preferably directs the or each optical fibre exiting through it away from the plane of the guide element (e.g. the plane of the plate, for embodiments in which the guide element is in the form of a plate) and towards the storage tray in which is it stored. The or each storage tray preferably extends away from the guide element to which it is directly or indirectly attached at an angle in the range 35° to 90°, preferably 40° or 45° to 90°, with respect to the plane of the guide element (the trays are preferably pivotable within the range of angles 35° to 145°, more preferably 45° to 135°, to this plane). Thus, the directing of the optical fibre(s) by the guide exit normally helps to avoid significant stresses being placed on the optical fibre(s) in the region between the guide and the tray. Advantageously, the exit of the or each guide may comprise a ramp or the like which directs the optical fibre(s) away from the plane of the guide element with a minimum bend radius which is at least equal to the critical bend radius of the fibre(s).

When the terms "entrance" and "exit" are used herein, they generally do not refer to the direction of light signals carried by the optical fibres, but instead refer to the normal direction in which the optical fibres are inserted into the optical fibre guides, and the direction in which they exit the guides while being passed through the guides. Ordinarily, optical fibres (normally carried by tubes or other carriers, or in ribbons of say 4 to 12 fibres) are inserted into, and guided through, the optical fibre guides in the guide elements before they are stored in the optical fibre storage trays.

When it is stated herein that the optical fibre guides are arranged to guide at least part of the lengths of optical fibres which extend between the exterior of the organizer and the storage trays, this includes the possibility that the fibres are in ribbons or other carriers, or that one or more tubes or other carriers are placed on or around such lengths of fibres inside or outside the organizer.

Advantageously, the or each optical fibre guide of the, or at least one, guide element of the kit is arranged to guide at least one ribbon (preferably only one ribbon) of optical fibres. More preferably, the guide exit is wider, in the plane of the guide element, than the guide entrance, such that, in use, a ribbon of fibres is guided into the guide entrance with its width (i.e. its relatively wide dimension) at least approximately perpendicular to the plane of the guide element (e.g. at least 60°, and preferably at least 70°, to the plane of the guide element), and is guided out of the guide exit with its width approximately parallel to the plane of the guide element (e.g. no more than 40°, and preferably no more than 30°, to the plane of the guide element). The width of the guide entrance is preferably no greater than 5mm, more preferably no greater than 3mm, e.g. about 2mm. The width of the guide exit is preferably at least 5.5mm, more preferably at least 6mm or 7mm.

Accordingly a ninth aspect of the invention provides an optical fibre guide element, comprising a plate to which one or more optical fibre storage tray(s) may be directly or indirectly attached, the or each guide element including one or more optical fibre guide(s) for guiding one or more ribbon(s) of optical fibres into a said storage tray, the or each guide having an entrance and an exit through which said ribbon(s) of fibres may extend, respectively, into the guide, and out of the guide and into a said tray, and whereby the guide exit is wider, in the plane of the plate, than the guide entrance, such that, in use, a ribbon of fibres is guided into the guide entrance with its width at least approximately perpendicular, and is guided out of the guide exit with its width at least approximately parallel, with respect to the plane of the plate.

This aspect of the invention has the advantage that significant stresses on the optical fibres of the ribbon are substantially prevented. This is because the ribbons may be guided into the guides in a plane substantially parallel to the plane of the guide element, and because the width of the ribbon is approximately perpendicular (e.g. 60° to 90°, preferably 70° to 90°) to these planes, the ribbon may be bent within this plane in order to be routed into the guide. The ribbon is gradually twisted in the guide from entrance to exit so that at the exit of the guide its orientation is approximately or substantially perpendicular to it entrance orientation. The ribbon may therefore be bent in order to be routed into a storage tray attached, in use, directly or indirectly to the guide element, which storage tray is oriented at an angle of, say, 35° to 90°, preferably 45° to 90° with respect to the plane of the guide element. The bending of the ribbons of optical fibres should, of course, respect the critical bend radius of the individual fibres.

The or each optical fibre guide in an optical fibre guide element preferably comprises a groove in the element. Preferably, each guide element has a plurality of such grooves in a surface thereof. The guides are preferably arranged in a mutually substantially parallel series. Adjacent guides in the series are preferably oriented in opposite directions, such that the entrance of one guide is next to the exit of an immediately adjacent guide, and vice versa. In use, two or more guide elements are preferably attached to the base and/or connected to each other, in a series (e.g. extending along the base). The guides in the guide elements are preferably substantially perpendicular to the direction of extension of the series of guide elements. The optical fibre storage trays are preferably arranged, in use, in a series along the series of guide elements. The optical fibre storage trays are preferably substantially parallel to the guides, and extend away from the plane of the guide elements. Optical fibre(s) guided through one or more of the guides is/are preferably routed into a respective optical fibre storage tray from the exit(s) of the guide(s).

In some preferred embodiments of the invention, each guide element includes mounting means for mounting a plurality of optical fibre storage trays thereto. In such

embodiments, therefore, the guide elements themselves comprise support plates. When optical fibre storage trays are attached, the combinaion comprises a storage module.

In other preferred embodiments of the invention, the kit further comprises at least one support element to which, in use, the or each optical fibre storage tray is directly attached, which support element is directly or indirectly attached to the optical fibre guide element. Preferably, the or each optical fibre storage tray is pivotally attached to the support element. The support element preferably has the form of a plate or other generally flat structure.

The kit may further comprise at least one cover plate which, in use, it attached to at least one respective guide element such that it overlies the or each groove, thereby substantially preventing lateral displacement of optical fibres from said groove(s). The or each cover plate may comprise a continuous plate, or it may contain holes or be in the form of a grid etc. The or each support element (where present) is preferably attached, in use, to at least one cover plate.

Most preferably, therefore, for some embodiments, in use, the guide elements are attached to the base and/or to each other, the cover plate(s) is/are attached to the guide elements, the support element(s) is/are attached to the cover plate(s), and the optical fibre storage trays are attached to the support element(s). In such embodiments, therefore, a guide element, cover element and support element together comprise a support plate. When the optical fibre storage trays are attached, it comprises a storage module. The attachments may generally be made in any suitable way. Preferably, however, the various parts of the kit interlock (e.g. as a snap-fit) with the or each part to which they are attached in use. Alternatively, other fastening means, e.g. adhesive, screws, nuts and bolts or the like may be used.

The invention will now be described, by way of example, with reference to the accompanying drawings, of which:

Figures 1A-1C show a modular support plate for hinged optical fibre storage trays;

Figures 2A-2B show another modular support plate for hinged optical fibre storage trays;

Figure 3 shows an assembled optical fibre organizer according to the invention attached to a base of a cable closure;

Figures 4A-4B show, schematically, another assembled optical fibre organizer according to the invention attached to a base of a cable closure;

Figure 5 shows a further assembled optical fibre organizer according to the invention attached to a base of a cable closure;

Figure 6 is a schematic illustration of the major parts of another kit according to the invention;

Figure 7 is a perspective illustration of the parts shown in Figure 6;

Figure 8 is a detail of a guide element of a kit according to the invention;

Figure 9 is an illustration of a series of optical fibre storage trays attached to support plates and cover plates, of a kit according to the invention; and

Figure 10 is an illustration of a closure according to the invention.

Figure 1 shows a modular support plate 1 comprising a plurality of pairs of mounting means 3 in the form of integral moulded protrusions standing up from the plate. The mounting means 3 contain apertures for receiving hinge pins formed on the

storage trays. The storage trays are therefore hinged with respect to the support plate in use. Each of the trays may therefore be accessed by pivoting all of the trays on one side of the tray, away from the tray. Figure 1 also shows flexible tines 4 (also protruding from the support plate) which lock the hinge pins of the trays in the mounting pins 3.

Each pair of mounting means 3 is associated with a respective guide 5 which is in the form of an open-sided groove in the plate. In use, an optical fibre storage tray 7 (see Figure 3) is attached to a particular pair of mounting means 3, and one or more optical fibres or ribbons of optical fibres extending from the tray is received in the respective guide groove 5. Because the guide grooves 5 are open-sided, such optical fibres are inserted into them by "side-entry", i.e. without having to thread the fibres through an aperture. This has the advantage of enabling uncut (looped) optical fibres to be stored in the trays, for example in single circuits or single elements.

Each guide groove 5 includes four ramps 9 which, in use, guide one or more optical fibres or ribbons of optical fibres between the guide and its respective storage tray, i.e. the ramps guide the fibres away from the support plate towards the hinged tray mounted on the support plate. The ramps are situated in a relatively wide central region 11 of each guide. At each end 13 of the guide, the guide is narrower in width and is also curved in the plane of the support plate. At the ends of the guides, and extending substantially perpendicularly to the straight central regions of the guides, are optical fibre routing channels 15, for routing the optical fibres or ribbons from the guides 5 to the exterior of the organizer. An optical fibre, or a ribbon of optical fibres, may therefore extend from the exterior of the organizer (e.g. from a cable) along one routing channel 15 and into one end 13 of a respective guide 5. The fibre or ribbon may extend along the guide 5 across part of the width of the support plate and up one or both ramps into a storage tray mounted to the support plate (mounted by attachment to the respective mounting means 3). The fibre or ribbon may be looped one or more times in the storage tray, extend out of the tray and down the opposite ramps into the same guide 5. It will extend along the guide 5 past the first ramps out of the opposite

end of the guide, into the other routing channel 15 and then to the exterior of the organizer.

When ribbons of optical fibres are used, the major width of the ribbons will generally be substantially perpendicular to the plane of the support plate in the routing channels 15 and the relatively narrow end regions 13 of the guides 5. However, in the relatively wide central regions 11 of the guides, the ribbons will normally twist through about 90° so that in the regions where they are guided towards the trays by the ramps 9 their major widths will generally be substantially parallel to the plane of the support. The dimension of the guides are preferably predetermined to cause or facilitate this change in the orientation of the ribbons which is required because optical fibre ribbons generally must not be bent about an axis which is perpendicular to their major width.

The support plates illustrated in Figures 2A and 2B are similar to the support plate illustrated in Figure 1, except that the routing channels comprise a plurality of narrow channels 17 designed to route optical fibre ribbons orientated such that their major width is substantially perpendicular to the plane of the support plates. In Figure 2B two support plates are arranged side-by-side, thereby forming a larger support plate.

Figure 3 shows an optical fibre organizer 19 according to the invention, which has been assembled and attached to a base 21 of a cable closure. The organizer 19 comprises a support frame 23 and a plurality (three as drawn) storage modules 25 attached to the support frame 23 side-by-side such that their support plates 27 together form a larger support plate.

Each storage module 25 comprises a support plate 27 (of different design to the support plates shown in figures 1 and 2) supporting a plurality of hinged optical fibre storage trays 7. Each support plate 27 includes attachment devices 29 which are interlocked (by a snap-fit) with the support frame 23.

The support frame 23 is formed in two parts, each of which comprises a pair of spaced-apart elongate parts 31 which are interconnected by an elongate cross-member 33. Each elongate part 31 is anchored to the base 21 of the closure. The support frame 23 as illustrated comprises a plurality of interconnected tubes (e.g. formed from metal), but other types of frame are possible, for example as shown in Figure 5.

Figures 4A and 4B are schematic illustrations of another assembled optical fibre organizer 35 according to the invention, which is also attached to a base 21 of a closure. This organizer includes three different modules attached to the support frame 23 side-by-side. One of the modules is a storage module 25 as shown in Figure 3. The module adjacent to the storage module 23 is a guide module 37 comprising a support plate 27 supporting a plurality of curved wall projections 39 between which optical fibres may be guided. Adjacent to the guide module 37 is a break out module 40 comprising a support plate 27 supporting a plurality of breakout means 41. Even though there is a gap between each adjacent support plate 27 attached to the support frame, the effect is the formation of a larger support plate containing all of the various module elements.

Figure 5 shows a further organizer according to the invention attached to a base of a closure.

Figure 6 is schematic illustration of another kit of parts 101 according to the invention. The kit comprises one or more optical fibre storage trays 7, one or more support elements 105 (in the form of plates), one or more cover plates 107, one or more guide elements 109 (in the form of plates) and one or more bases 111 (also in the form of plates). A support element 105, a cover plate 107, and a guide element 109 together comprise a support plate (i.e. when they are connected together), e.g. equivalent to those shown in Figures 1 to 5. A support element, cover plate, guide element and optical fibre storage trays together comprise a storage module.The guide elements 109 may be attached to the main surface 112 of the base 111 (see Figure 7)

to form a series of guide elements along the base. The attachment of the guide elements 109 to the base 111 is preferably by means of interlocking parts (not shown), or by means of adhesive.

The various parts of the kit 101 are shown in greater detail in Figure 7. Two optical fibre storage trays 7 are illustrated. The trays 7 are generally round (oval) in shape, although other shapes could be used. Optical fibres are stored, in use, on a major surface 113 of the tray 7 and are retained in place by means of fibre retainers 115. Optical fibre splices, splitters, connectors, or other devices may also be stored on the trays, in the device retainers 117. The trays 7 are pivotally attached, in use, to a support element 105, by means of pivot pins 119. This is shown in greater detail in Figure 9, which shows a series of optical fibre storage trays 3 (which are slightly different to those shown in Figure 7) pivotally attached to two support elements 105 which are in turn attached to two cover plates 107 (the support elements 105 and the cover plates 107 being substantially the same as those shown in Figure 7). The pivot pins 119 are located in holes 120 on the support elements 105, and are retained in place by means of an extending arm 121 of the tray which is held in place by flexible tines 123 on the support elements 105. The trays 7, as illustrated in Figure 9, are inclined at an angle of about 45° with respect to the plane of the support elements/cover plates (which plane is parallel to those of the guide elements and the base). The trays can preferably pivot between about 45° and about 135° to these planes, to allow access to the surface 113 of each tray in the series.

In Figure 9, the support elements 105 are attached (preferably as an interlocking snap-fit) to the cover plates 107. The cover plates 107 have holes 125 which, in use, interlock with corresponding resilient protrusions 127 on the guide elements 109 (see Figures 7 and 8). The cover plates 107 also have upwardly - inclined (i.e. inclined towards the trays 7) portions 129 which contain upwardly - inclined openings 131. In use, these openings 131 each contain an exit ramp 133 of a guide 135 of a guide element 109 (see Figure 8).

Each guide element 109 (of which a part, including four guides 135, is shown in Figure 8) comprises a series of guides 135 in the form of mutually substantially parallel grooves. Adjacent guide grooves 135 in the series are oriented in opposite directions, such that the entrance 137 of one guide groove 135 is next to the exit 133 of an immediately adjacent guide, and vice versa. Towards the exit 133 of each guide groove 135, the guide groove becomes shallower, and at the exit 133 is a ramp which, in use directs optical fibres extending out of the exit away from the plane of the guide element plate 109 and towards a respect optical fibre storage tray 7 attached above the guide element plate 109, as indicated by the arrow A. Also, on going from the entrance 137 to the exit 133 of each guide groove 135, the guide groove becomes narrower in width (i.e. in the plane of the guide element plate 109). This has the effect, in use, of twisting (or turning) a ribbon of optical fibres (not shown) extending along the guide groove 135, from an orientation in which, at the entrance 137 the width of the ribbon is substantially perpendicular to the plane of the guide element plate, to an orientation in which, at the exit 133 the width of the ribbon is substantially parallel to the plane of the guide element plate. This has the advantage that a ribbon of optical fibres entering the organizer as indicated in Figure 7 by arrow B, i.e. along the base 111 in a vertical orientation (i.e. with its relatively wide dimension substantially perpendicular to the plane of the base plate 111) may be bent into a guide groove 135 of a guide element 109 attached to the base plate 111, and upon exiting the guide groove 35 it may be bent in order to route it into a tray 7 which is oriented at an angle of between about 45° and 90° to the base plate.

Figure 10 shows a closure 139 according to the invention. The closure 139 comprises a two-part casing (a bottom part 141 and a top-, or dome-part 143) and an optical fibre organizer 101 according to the invention. The closure includes two bases 111 (which, for clarity, are illustrated without trays or other attachments) which are mounted on the bottom part 141 of the casing. The parts 145 of the bases 111 contain optical fibre routing and management devices. The bottom part 141 includes cable-entry ports 147. The dome-part 143 may be secured to the bottom-part 141 by means

of a clamping ring (not shown), and the closure is preferably sealed by an O-ring between the bottom part 141 and the dome-part 143.

Claims

1. A kit of parts for forming an optical fibre organizer, comprising at least two different modules selected from the following different modules:

(i) a storage module comprising a support plate supporting at least one optical fibre storage means;

(ii) a breakout module comprising a support plate supporting at least one optical fibre breakout means; and

(iii) a guide module comprising a support plate supporting a plurality of projections between which optical fibres may be guided;

whereby each module is attachable either directly or indirectly to each other module such that their support plates are arranged side-by-side and thereby together form a larger support plate.

2. A kit according to Claim 1, further comprising a support to which each module may be attached, thereby indirectly attaching each module to the or each other module.

3. A kit of parts for forming an optical fibre organizer, comprising:

(a) a support; and

(b) at least two different modules selected from the following different modules:

(i) a storage module comprising a support plate supporting at least one optical fibre storage means;

(ii) a breakout module comprising a support plate supporting at least one optical fibre breakout means;

(iii) a guide module comprising a support plate supporting a plurality of projections between which optical fibres may be guided;

whereby the modules are attachable to the support side-by-side such that their support plates together form a larger support plate.

4. A kit according to Claim 2 or Claim 3, in which the support comprises a plurality of interconnectable parts.

5. A kit according to any one of claims 2 to 4, in which the support comprises a frame.

6. A kit according to any preceding claim, in which the or each optical fibre storage means comprises a tray.

7. A kit according to Claim 6, in which the or each optical fibre storage tray is hinged with respect to the support plate which supports it.

8. A kit according to Claim 6 or Claim 7, in which the or each optical fibre storage module includes a plurality of said optical fibre storage trays.

9. A kit of parts for forming an optical fibre organizer, comprising:

(a) a support frame; and

(b) a plurality of modules, each of which comprises a support plate supporting at least one of the following:

(i) a plurality of hinged optical fibre storage trays;

(ii) at least one optical fibre breakout means;

(iii) at least one optical fibre guide means;

whereby the modules are attachable to the support frame side-by-side such that their support plates together form a larger support plate.

10. A kit according to any one of claims 5 to 9, in which the support frame comprises at least two spaced-apart parts to which each module may be attached such that its support plate substantially spans the gap between the spaced-apart parts.

11. A kit according to Claim 10, in which each spaced-apart part is elongate in shape.

12. A kit according to Claim 10 or Claim 11, in which the support frame further comprises at least one elongate cross-member which extends between the two elongate parts.

13. A kit according to any one of claims 2 to 12, in which each module, preferably the support plate thereof, includes one or more attachment devices by which it may be attached to the support.

14. A kit according to Claim 13, in which each attachment device is interlockable with the support.

15. A kit according to any preceding claim, in which the or each storage module may store at least one loop of optical fibre without bending the fibre below its critical bend radius.

16. A kit according to any preceding claim, in which the or each optical fibre breakout means comprises a first passage for retaining a first tube carrying a plurality of optical fibres, and a plurality of second passages for retaining a plurality of second tubes each of which carries at least one optical fibre extending from the first tube.

17. A kit according to any preceding claim, in which the or each optical fibre breakout module includes a plurality of optical fibre breakout means.

18. A kit of parts for forming an optical fibre organizer, comprising:

(a) one or more optical fibre storage tray(s);

(b) at least one optical fibre guide element, to which said one or more optical fibre storage tray(s) may be directly or indirectly attached, the or each guide element including one or more optical fibre guide(s) arranged to guide at least part of the

length of at least one optical fibre, which length extends, in use, between the exterior of the organizer and said storage tray(s); and

(c) a base, to which a plurality of said guide elements may be directly or indirectly attached, the base comprising a frame.

19. A kit of parts for forming an optical fibre organizer, comprising:

(a) at least two optical fibre storage tray(s);

(b) at least two optical fibre guide elements, to each of which at least one said optical fibre storage tray may be directly or indirectly attached, each guide element including one or more optical fibre guide(s) arranged to guide at least part of the length of at least one optical fibre, which length extends, in use, between the exterior of the organizer and said storage tray(s);

wherein at least two said optical fibre guide elements may be directly connected together.

20. A kit according to claim 19, in which the at least two said optical fibre guide elements may be directly connected together in a self-supporting manner.

21. A kit according to any one of claims 18 to 20, in which the or each optical fibre guide element is in the form of a plate.

22. A kit according to claim 21, in which the or each optical fibre guide has an entrance and an exit through which, in use, said optical fibre(s) extend(s), respectively, into the guide, and out of the guide and into a said storage tray.

23. A kit according to claim 22, in which said guide exit directs the or each said optical fibre exiting therethrough away from the plane of the plate and towards said storage tray.

24. A kit according to any one of claims 18 to 23, in which the or each optical fibre guide of the, or at least one, guide element is arranged to guide at least one ribbon of optical fibres.

25. A kit according to claim 24 when dependent upon claim 22 or claim 23, in which the guide exit is wider, in the plane of the plate, than the guide entrance, such that, in use, a ribbon of fibres is guided into the guide entrance with its width at least approximately perpendicular to the plane of the plate, and is guided out of the guide exit with its width approximately parallel to the plane of the plate.

26. A kit according to any one of claims 18 to 25, further comprising at least one support element to which, in use, the or each said optical fibre storage tray is directly attached, which support element is directly or indirectly attached to said optical fibre guide element.

27. A kit according to claim 26, in which, in use, the or each optical fibre storage tray is pivotally attached to the support element.

28. A kit according to any one of claims 18 to 27, in which the or each said optical fibre guide comprises a groove in the optical fibre guide element.

29. A kit according to claim 28, further comprising at least one cover plate which, in use, is attached to at least one respective guide element such that it overlies the or each groove, thereby substantially preventing lateral displacement of optical fibres from said groove(s).

30. A kit according to claim 29 when dependent upon claim 26, in which, in use, said support element is attached to said cover plate.

31. A kit of parts for forming an optical fibre cable closure, comprising a kit according to any preceding claim, and a casing for enclosing the optical fibre organizer.

32. A kit according to Claim 18, in which the casing comprises a casing base containing cable ports, and a generally dome-shaped cover attachable to the casing base, the optical fibre organizer being attachable to the casing base.

33. An optical fibre organizer assembled from a kit according to any one of claims 1 to 30.

34. An optical fibre cable enclosure comprising a casing, and an optical fibre organizer according to claim 33 contained inside the casing.

35. An optical fibre guide element, comprising a plate to which one or more optical fibre storage tray(s) may be directly or indirectly attached, the or each guide element including one or more optical fibre guide(s) for guiding one or more ribbon(s) of optical fibres into a said storage tray, the or each guide having an entrance and an exit through which said ribbon(s) of fibres may extend, respectively, into the guide, and out of the guide and into a said tray, and whereby the guide exit is wider, in the plane of the plate, than the guide entrance, such that, in use, a ribbon of fibres is guided into the guide entrance with its width at least approximately perpendicular, and is guided out of the guide exit with its width at least approximately parallel, with respect to the plane of the plate.

36. A guide element according to claim 35, in which said guide exit directs the or each said optical fibre exiting therethrough away from the plane of the plate.

Fig.1A.

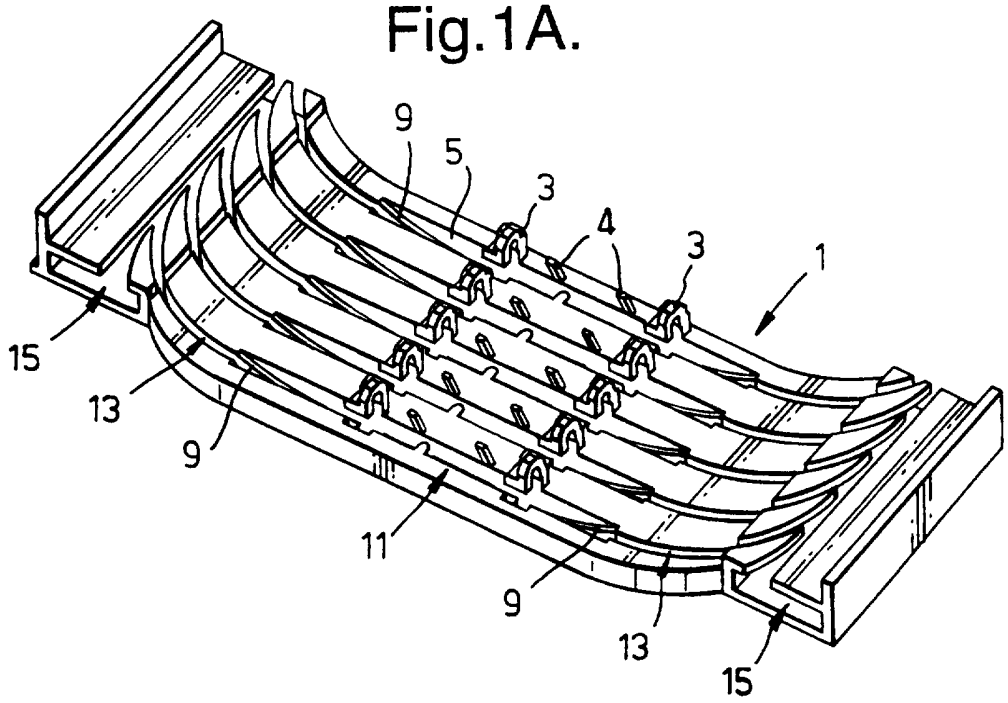

Fig.1B.

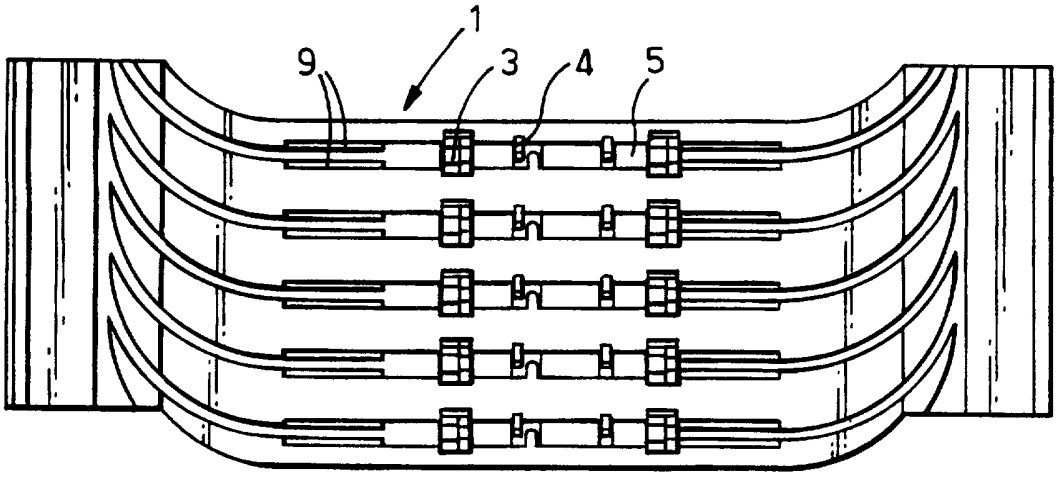

Fig.1C.

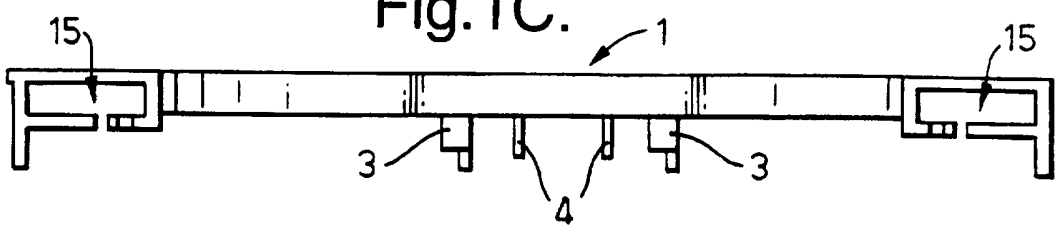

Fig.2A.

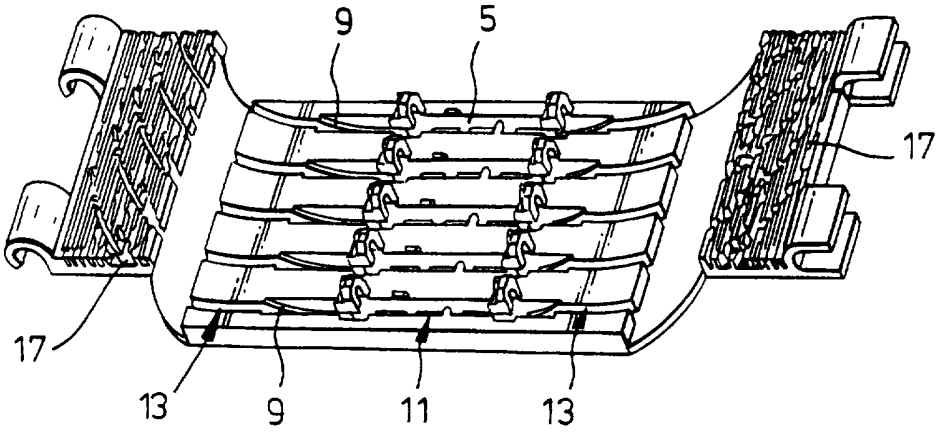

Fig.2B.

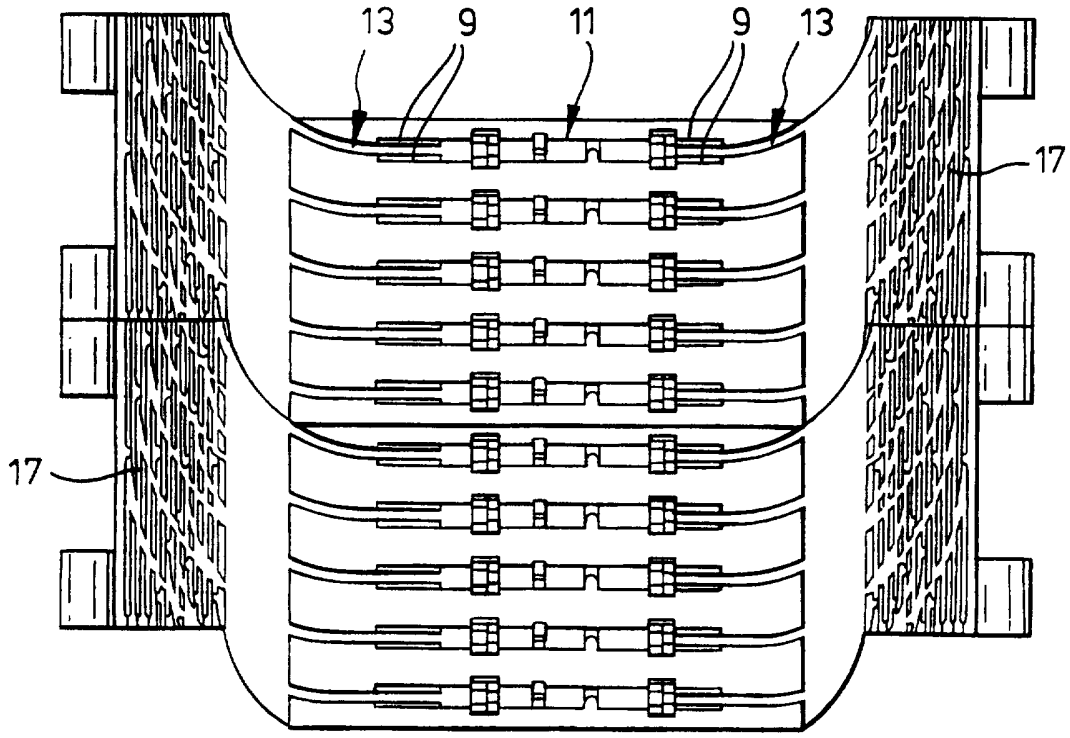

Fig.3.

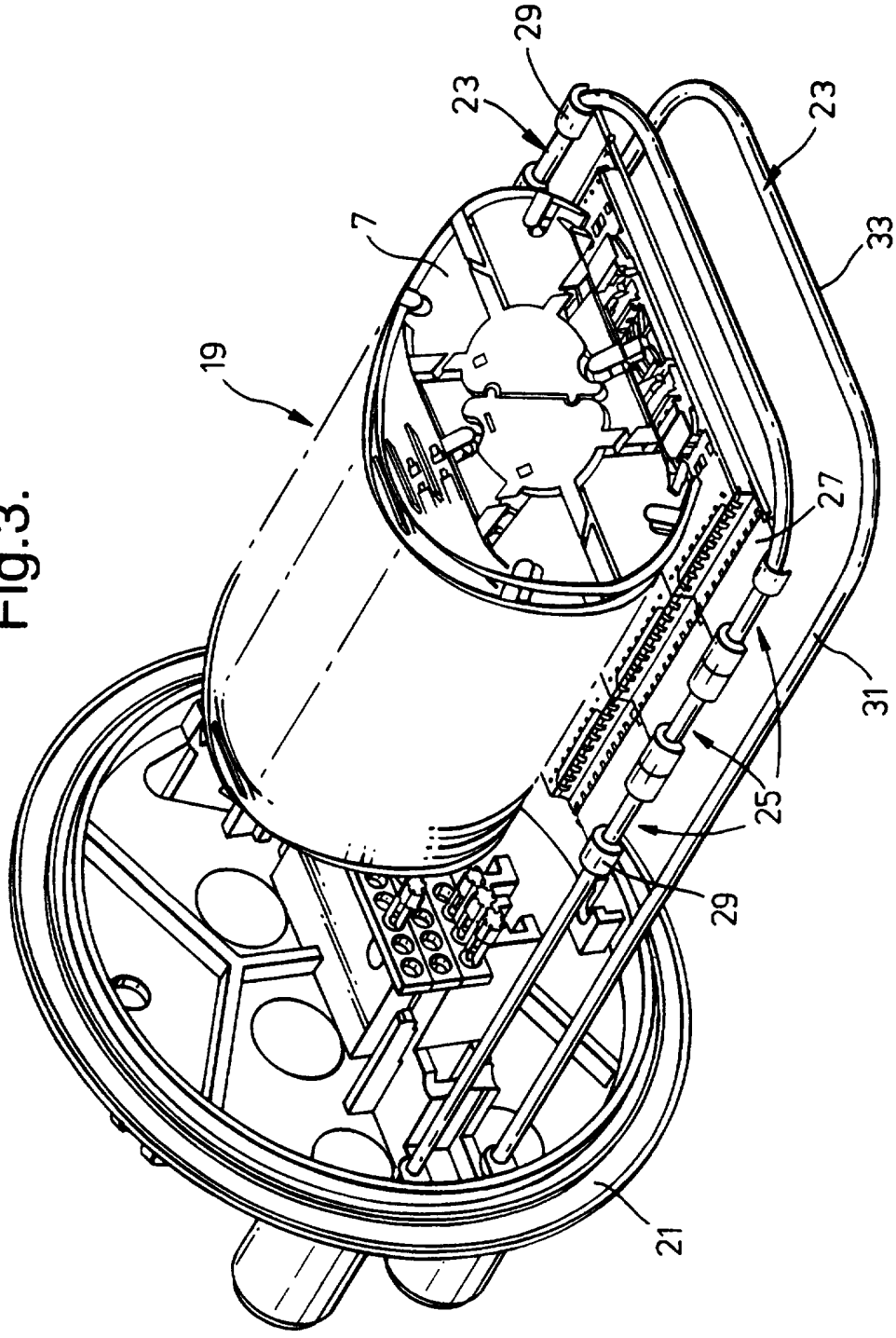

Fig.4A.

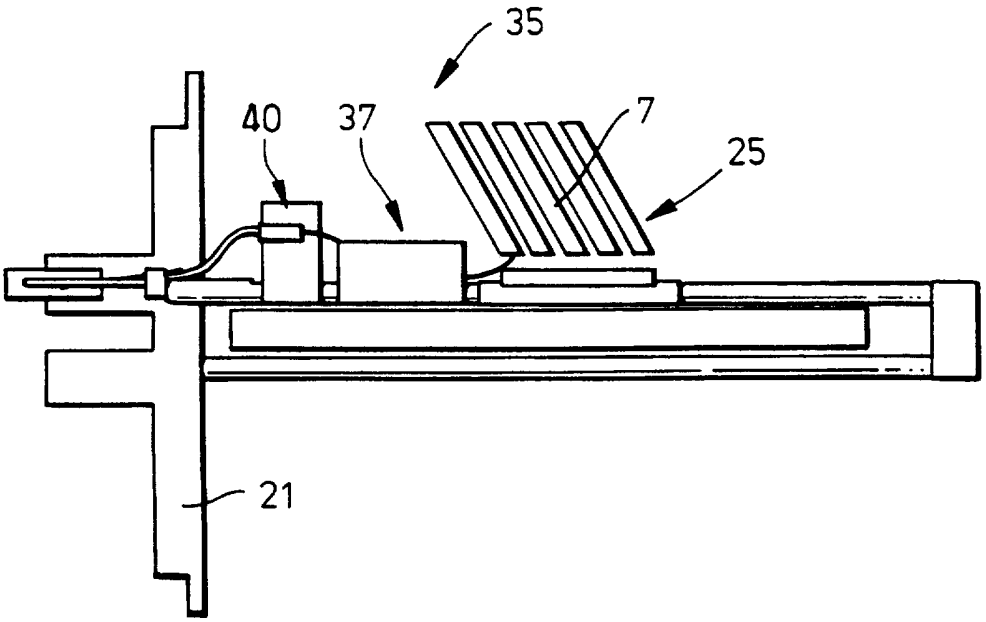

Fig.4B.

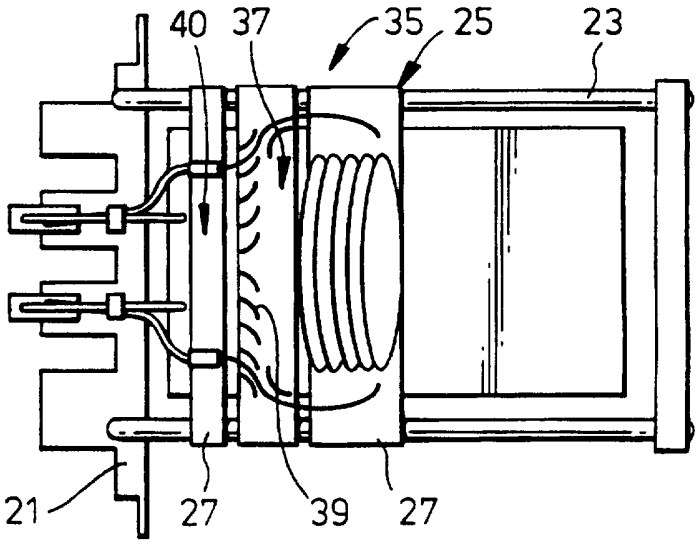

Fig.5.

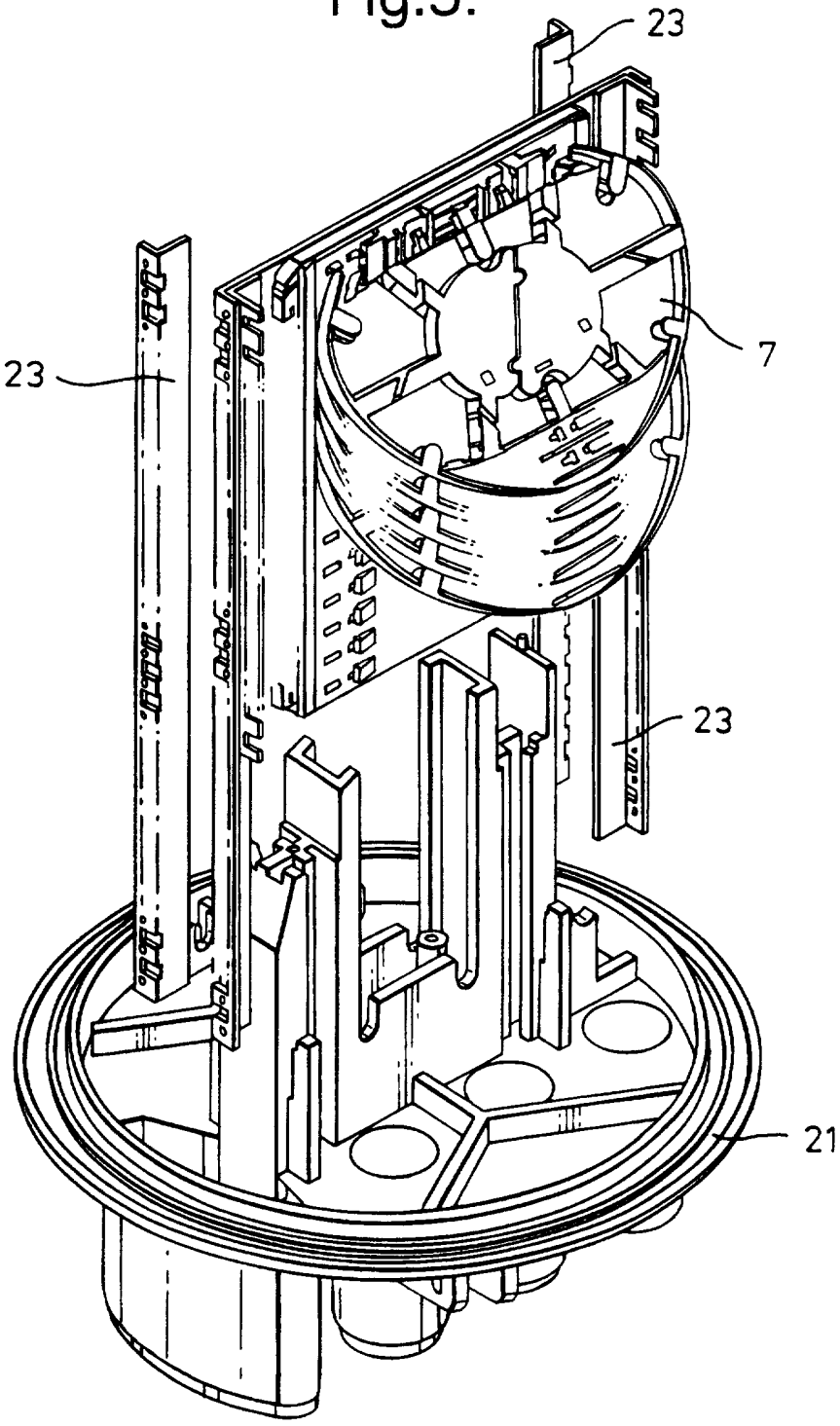

Fig.6.

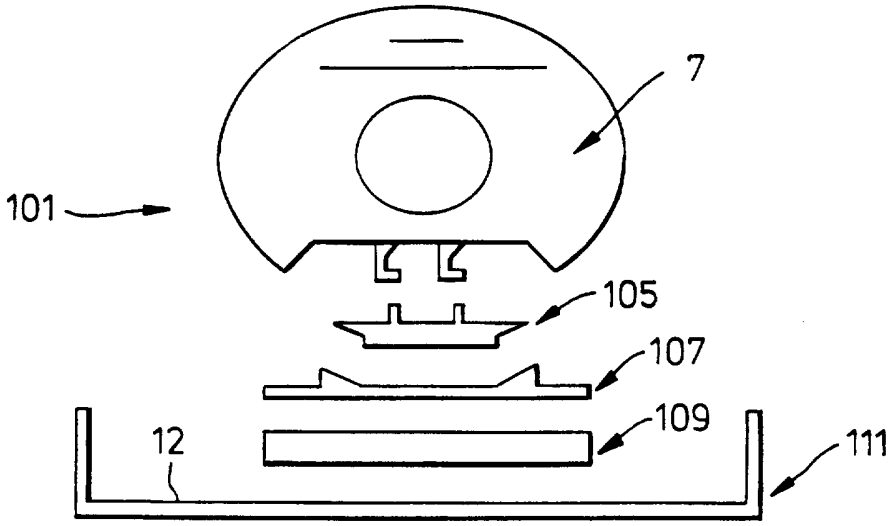
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Fig.7.

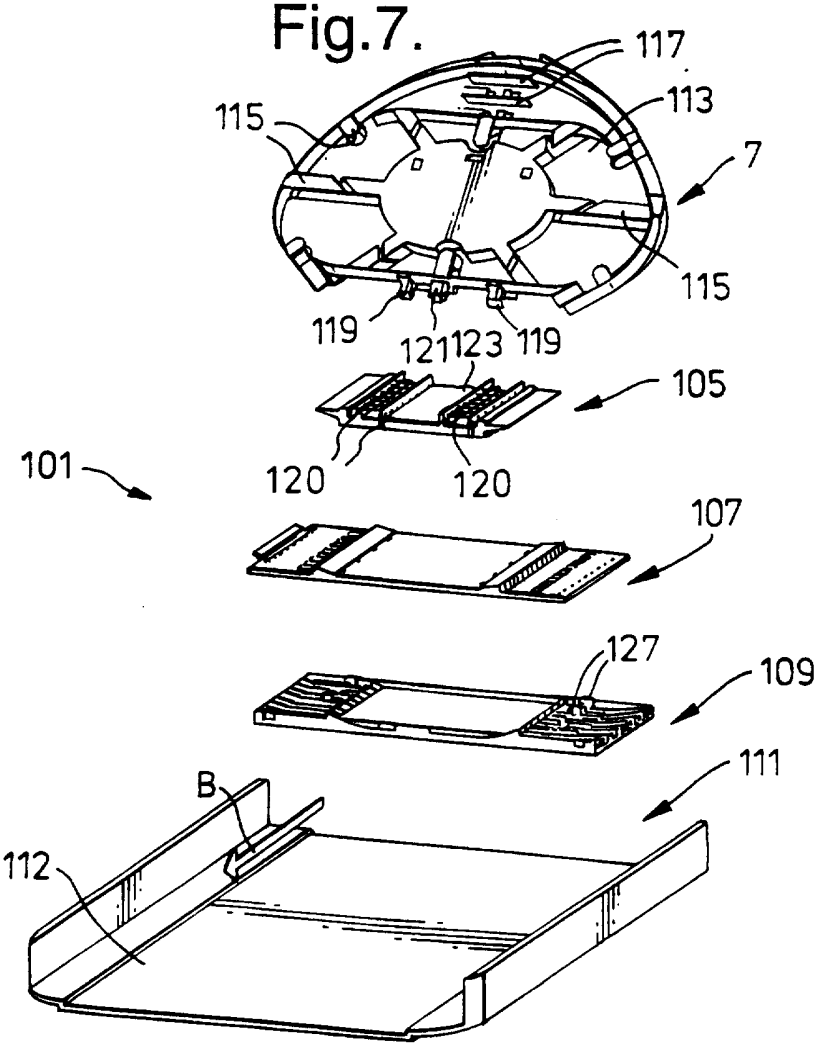
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Fig.8A.

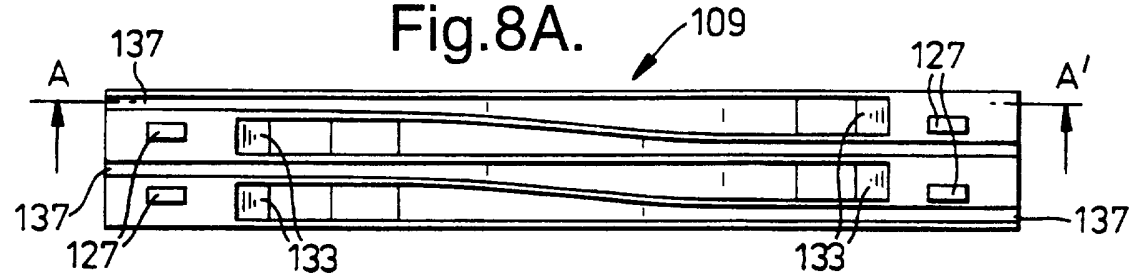
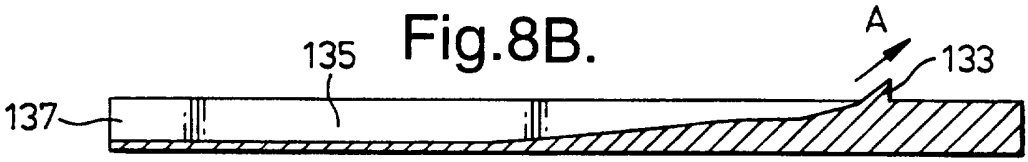


Fig.8B.



(A – A')

Fig.9.

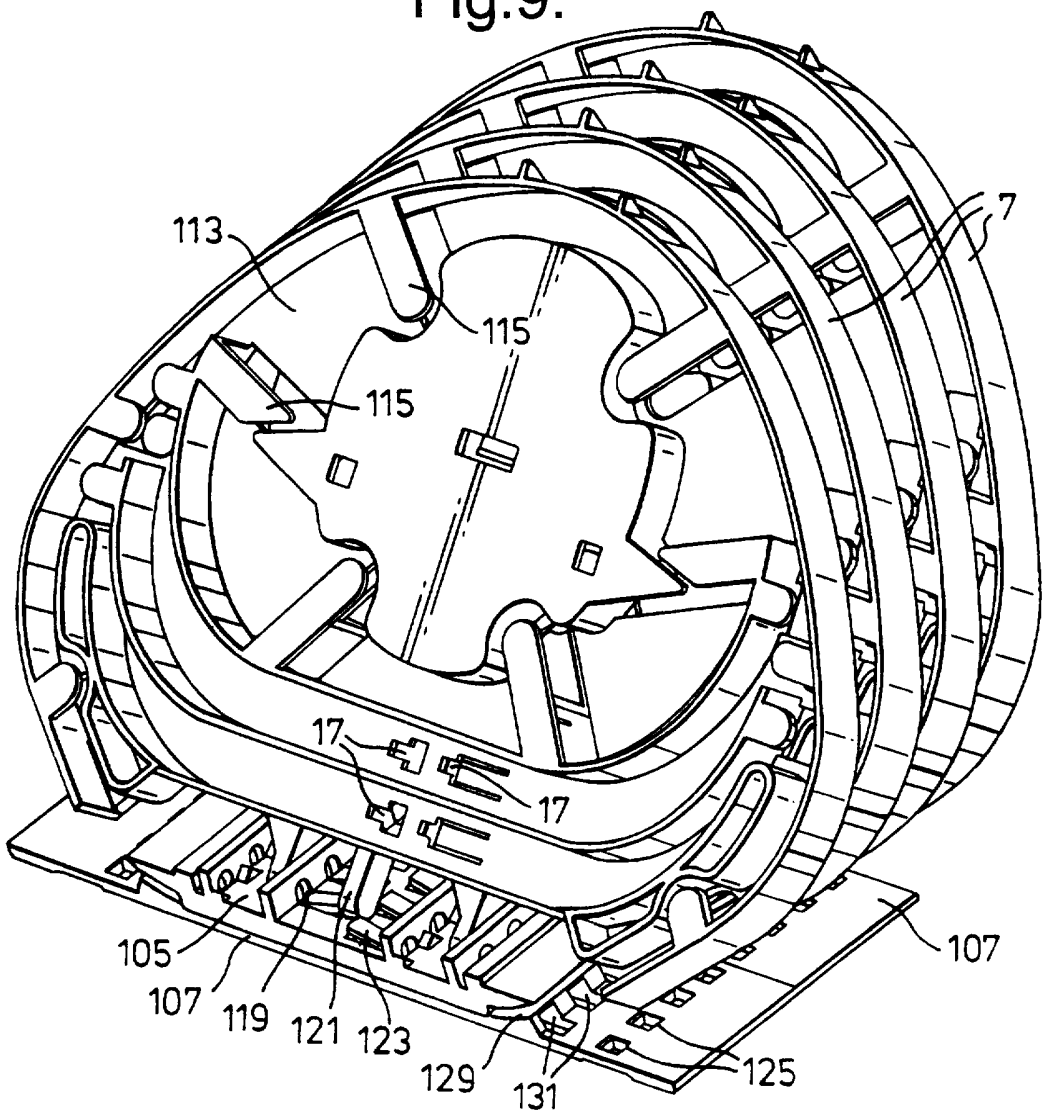
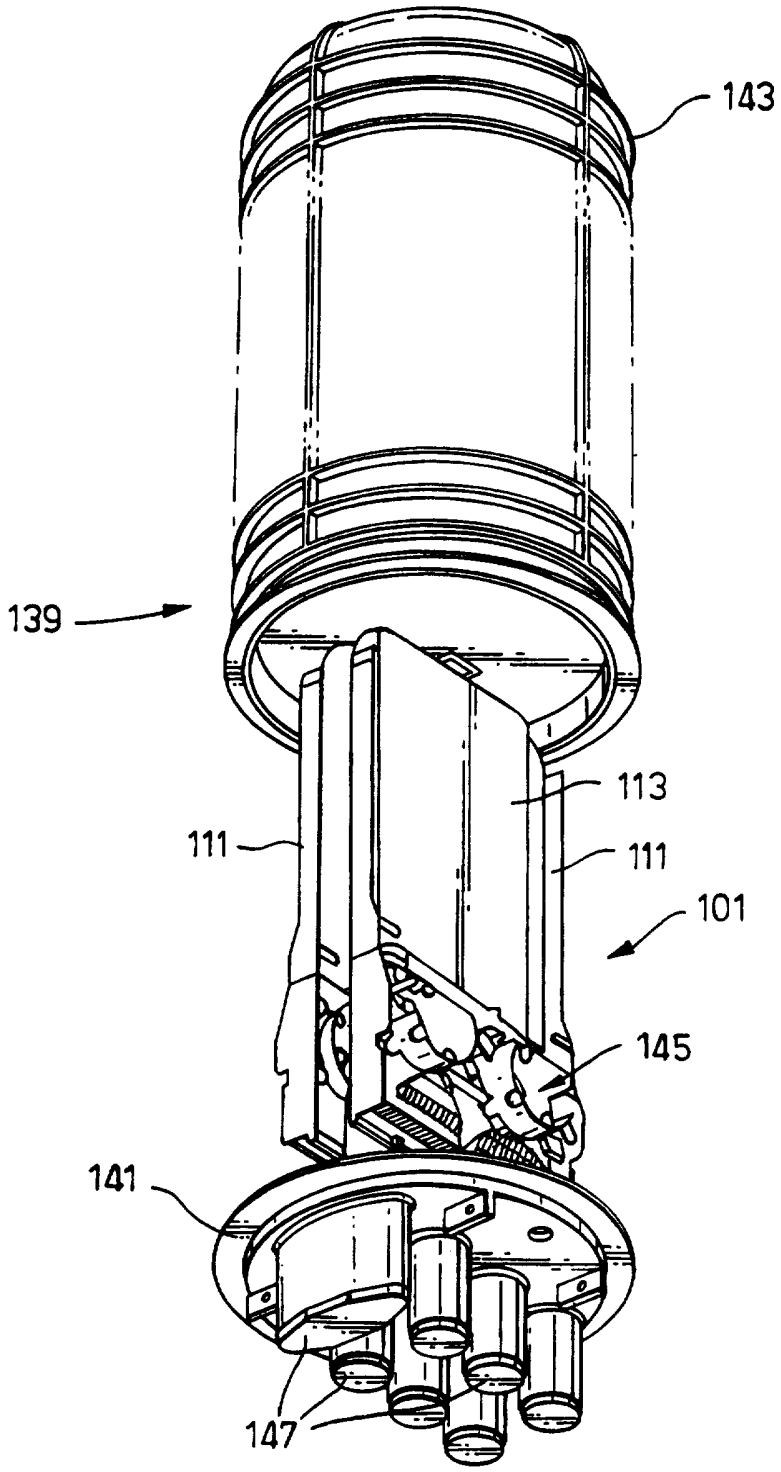


Fig.10.



INTERNATIONAL SEARCH REPORT

Intern al Application No
PCT/GB 97/00549

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G02B6/44

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y,P A	EP 0 715 196 A (SIEMENS AG) 5 June 1996 see claims; figures	1,3 4-6,9,16
Y,P A	DE 44 39 853 A (SIEMENS AG) 9 May 1996 see claims; figures	1,3 2,4-6,9, 13,15, 19,24, 31,32
A	WO 95 07480 A (RAYCHEM SA NV ;RAYCHEM LTD (GB); MACKEN LUK JOZEF (BE); DAEMS DANI) 16 March 1995 cited in the application	
A	WO 95 07475 A (BRITISH TELECOMM) 16 March 1995 cited in the application	

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

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1

Date of the actual completion of the international search	Date of mailing of the international search report
29 May 1997	11.06.97
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+ 31-70) 340-3016	Authorized officer Pfahler, R

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INTERNATIONAL SEARCH REPORT

Intern: al Application No
PCT/GB 97/00549

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	WO 95 25978 A (RAYCHEM SA NV ;RAYCHEM LTD (GB); MENDES LUIZ NEVES (BE)) 28 September 1995 cited in the application	
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