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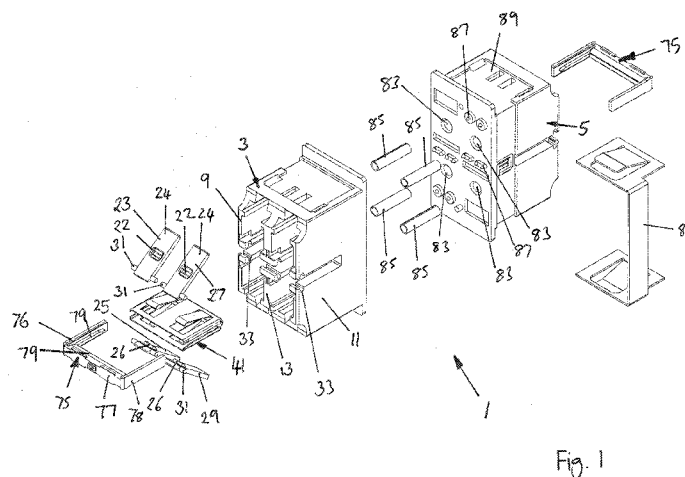


Fig. 1

(57) Abstract: A fibre optic cable adaptor (1) for fibre optic cable assemblies. The adaptor (1) includes: a first housing (3) arranged to receive a plurality of fibre optic connectors, said first housing (3) including a first part (3a) for receiving a first fibre optic connector and a second part (3b) for receiving a second fibre optic connector; a first shutter member (23) arranged to pivot relative to the first housing (3) between closed and open positions in response to insertion of the first fibre optic connector along a first insertion axis; a second shutter member (27) arranged to pivot relative to the first housing (3) between closed and open positions in response to insertion of the second fibre optic connector along a second insertion axis; a spring unit (41) including a first spring member (45) arranged to bias the first shutter member (23) to a closed position and a second spring member (49) arranged to bias the second shutter member (27) to a closed position.

Fibre Optic Adaptor

The present invention relates to an adaptor for fibre optic cable assemblies.

In data communications systems fibre optic cables are often connected together via adaptors. An adaptor is arranged to receive a first cable in a recess on a first side and a second cable in a recess on a second side, and to hold the first and second cables together such that their ends are substantially axially aligned thereby enabling light from a transmitter cable to be received by a receiver cable.

A problem with this type of adaptor is that if a receiver cable is removed from the adaptor while the transmitter cable is transmitting light, then the light can escape from the adaptor, which is undesirable.

To address this problem, some adaptors include shutters to prevent the light from escaping. There are many different arrangements available. The inventors have identified that many of the adaptors available are unnecessarily difficult to manufacture and assemble, many do not allow for disassembly, and their constructions can be overly complex, which leads to a high part count.

A further problem with some adaptors is that the leading end of a fibre optic cable assembly, which typically includes a ferrule, can engage the shutter member on insertion. This is undesirable as the shutter member can transfer dirt to the ferrule, which can impair the operation of the optical fibre(s).

For adaptors that include a spring to bias the shutter to a closed position, when the spring fails, it is often necessary to replace the whole adaptor. This is because the arrangement of the adaptor is such that it is difficult to replace the spring. Thus the arrangements of many adaptors lead to unnecessary waste.

Many adaptors are only arranged to connect a small number of fibre optic cable assemblies together. Typically an adaptor provides a one-to-one connection. Thus in many applications a large number of adaptors are required. In order to reduce the number of adaptors required it is known to combine a plurality of one-to-one connections together, for

example to provide two-to-two connections, however known adaptor designs are not easily scalable, which can exacerbate manufacturing and assembly problems.

Another problem with current adaptors is that when undertaking fault analysis the shutter can obscure the view of the test signal sent down a transmitter fibre.

Accordingly the present invention seeks to provide an adaptor for fibre optic cable assemblies that mitigates at least one of the aforementioned problems.

According to one aspect of the invention there is provided a fibre optic cable adaptor, said adaptor including: a first housing arranged to receive a plurality of fibre optic connectors, said first housing including a first part for receiving a first fibre optic connect and a second part for receiving a second fibre optic connector; a first shutter member arranged to pivot relative to the first housing between closed and open positions in response to insertion of the first fibre optic connector along a first insertion axis; a second shutter member arranged to pivot relative to the first housing between closed and open positions in response to insertion the second fibre optic connector along a second insertion axis; a spring unit including a first spring member arranged to bias the first shutter member to a closed position and a second spring member arranged to bias the second shutter member to a closed position.

In the closed positions, the first and second shutters are arranged to block and/or diffuse light emitted from corresponding fibre optic cable assemblies attached to a second housing along a corresponding insertion axis.

In the invention, a single spring unit is arranged to bias the first and second shutter members into their closed positions. This provides a very efficient arrangement. Each of the shutter members is arranged to pivot independently of the others.

Advantageously at least one, and preferably each, of the shutters members is inclined its respective insertion axis when in its closed position. Having each of the shutter members inclined to their respective insertion axes reduces the likelihood of ferrules engaging the shutter members and reduces the angle through which the shutter members have to pivot in order for a connector to be inserted into the adaptor.

Advantageously the spring unit is located between the first and second parts of the housing. This enables the spring to act on each of the first and second shutter members easily. Advantageously the spring unit separates the first and second parts of the housing. Advantageously the spring unit can be located in a central portion of the first housing with the first part located on one side of the spring unit and the second part located on the other side of the spring unit. The first part is located above the spring unit and the second part is located below the spring unit, when the first housing is oriented substantially vertically.

The first housing includes at least one slot and the spring unit can be located in the at least one slot. This enables easy assembly. Advantageously the first housing includes first and second side walls. The first side wall includes a first slot and the second side wall includes a second slot. The spring unit is located in the first and second slots. Advantageously the spring unit is arranged substantially perpendicularly to the side walls.

The spring unit can be arranged to slide into the or each slot. Advantageously the spring unit is removably mounted in the or each slot. This enables easy disassembly, and where necessary replacement of the spring. Advantageously the spring unit can slide into and out of the first and second slots formed in the first and second side walls. Advantageously the or each slot is arranged substantially parallel to at least one of the first and second axis of insertion.

Advantageously the spring unit can include a body and each of the first and second spring members is cantilevered to the body. This provides a robust spring that can be used for biasing a plurality of shutter members. Advantageously each spring member comprises a tongue attached to the body. Preferably the first and second spring members are cantilevered to a rear part of the body. The rear part of the body is the part of the body that is furthest away from an open side of the first housing when the spring unit is located in-situ.

The first spring member is inclined to the body when the first shutter member is in its closed position. When the first shutter member is in the open position, the first spring member is pushed into a plane of the spring body. Advantageously the first shutter member is arranged substantially parallel with the first insertion axis when in the open position.

The second spring member is inclined to the body when the second shutter member is in its closed position. When the second shutter member is in the open position, the second spring member is pushed into a plane of the spring body. Advantageously the second shutter member is arranged substantially parallel with the second insertion axis when in the open position.

Advantageously the first and second spring members can be arranged opposite to one another. Advantageously the first spring member is positioned above the second spring member when the first housing is oriented such that the first part is located above the second part.

Advantageously the first spring member protrudes into the first part of the first housing.

Advantageously the second spring member protrudes into the second part of the first housing.

Advantageously the spring body can be substantially U-shaped in section.

Advantageously the spring unit can be made from sheet material. Preferably the spring unit is made from spring steel.

Advantageously the spring unit can comprise an integral unit. This provides a component that is easy to manufacture and that is robust. That is, the first spring member, second spring member and body comprise a unified body. For embodiments having more than first and second spring members, each of the spring members is part of the integral unit.

Advantageously at least one, and preferably each, of the spring members can include a profiled engagement end that is arranged to engage a formation on its respective shutter member. Advantageously at least one, and preferably each of, the shutter members can include a major inner surface. Advantageously at least one, and preferably each, shutter member can include a formation on its major inner surface that is arranged to engage with the profiled engagement end.

Advantageously the spring unit can include first and second body members connected together by an end wall, and the adaptor includes at least one support element for preventing the first and second body members from collapsing when a connector is

inserted. Thus the trim element comprises a three sided body that is substantially U-shaped. The at least one support element can comprise a trim element. The spring unit can include at least one of first, second and third open sides that are adapted to receive a part of the trim element. For example, each open side can be arranged to receive a rib to prevent the first and second members from collapsing. The trim element can be used to at least partially conceal the spring unit. Advantageously the trim element can be arranged to display indicia, such as descriptive text, and/or an image, such as a logo.

Advantageously each of the spring members can be connected to one of the first and second body members.

Advantageously at least one, and preferably each of, the shutter members can be pivotally attached to the first housing. The first shutter member is located in the first part of the first housing. The second shutter member is located in the second part of the first housing.

Advantageously at least one, and preferably each of, the shutter members can comprise a thin, substantially elongate rectangular body, having pivot pins located towards one end. The pivot pins are located in complementary formations in the first body.

Advantageously at least one, and preferably each of the shutter members can be arranged to snap fit to the first housing.

Advantageously at least one, and preferably each, of the shutter members can include a pivot end and a free end and is inclined in its closed position such that the pivot end is located closer to the open end of the first housing than its free end. The pivot end of at least one, and preferably each, of the shutter members is located in the central portion of the first housing when viewing the open end. Thus when the first part of the housing is located above the second part of the housing, and the first and second shutter members are in their closed positions, the first shutter member is inclined upwards from its pivot end and the second shutter member is inclined downwards from its pivot end.

Advantageously at least one of the shutter members, and preferably each shutter member, can include a recess in an outer surface that is arranged to prevent a ferrule attached to its respective fibre optic connector from coming into contact with the outer surface of the

shutter member. Advantageously at least one, and preferably each of, the shutter members includes a major outer surface. The recess is formed in the major outer surface.

Advantageously at least one of the shutter members can be made from a translucent material. This helps a user to see a test signal, for example a red light source.

Advantageously the first housing can include a third part arranged receive a third fibre optic connector.

Advantageously the first housing can include a fourth part arranged to receive a fourth fibre optic connector.

In preferred embodiments, the first and third parts are arranged side by side and the second and fourth parts are arranged side by side, such as in a two by two array.

Advantageously the adaptor can include a third shutter member arranged to pivot relative to the first housing between closed and open positions in response to insertion of a third fibre optic connector along a third insertion axis. Advantageously the third shutter member can be arranged similarly to the first shutter member. Advantageously the third shutter member can be inclined to the third insertion axis when in its closed position.

Advantageously the adaptor can include a fourth shutter member arranged to pivot relative to the first housing between closed and open positions in response to insertion of a fourth fibre optic connector along a fourth insertion axis. Advantageously the fourth shutter member can be arranged similarly to the second shutter member. Advantageously the fourth shutter member can be inclined to the fourth insertion axis when in its closed position.

Advantageously the spring unit can include a third spring member arranged to bias the third shutter member to a closed position. Advantageously the third spring member can be arranged similarly to the first spring member.

Advantageously the spring unit can include a fourth spring member arranged to bias the fourth shutter member to a closed position. Advantageously the fourth spring member can be arranged similarly to the second spring member.

The spring unit can be located between the third and fourth parts of the first housing. Advantageously the first housing can include a central partition and the spring unit can be located in slots formed in the central partition and the first and second side walls.

Advantageously the third and fourth spring members can be arranged opposite to one another. The first and third spring members can be arranged side by side. The second and fourth spring members can be arranged side by side.

The third spring member protrudes into the third part of the first housing, and the fourth spring member protrudes into the fourth part of the first housing.

Advantageously the adaptor can include a second housing.

Advantageously the second housing is ultrasonically welded to the first housing.

Advantageously the second housing is arranged to receive a plurality of fibre optic connectors.

The second housing can include a first part arranged to receive a first fibre optic connector along the first insertion axis that when located in-situ is substantially axially aligned with the first fibre optic connector of the first housing.

The second housing can include a second part arranged to receive a second fibre optic connector along the second insertion axis that when located in-situ is substantially axially aligned with the second fibre optic connector of the first housing.

The second housing can include a third part arranged to receive a third fibre optic connector along the third insertion axis that when located in-situ is substantially axially aligned with the third fibre optic connector of the first housing.

The second housing can include a fourth part arranged to receive a fourth fibre optic connector along the fourth insertion axis that when located in-situ is substantially axially aligned with the fourth fibre optic connector of the first housing.

Advantageously the adaptor can include a first light pathway between the first part of the first housing and the first part of the second housing, said pathway being arranged to enable light emitted from the first fibre optic connector assembly in the second housing to

be transmitted to the first part of the first housing. The first shutter member is arranged to block the light escaping from the first housing.

Advantageously the adaptor can include a second light pathway between the second part of the first housing and the second part of the second housing, said pathway being arranged to enable light emitted from the second fibre optic connector assembly in the second housing to be transmitted to the second part of the first housing. The second shutter member is arranged to block the light escaping from the first housing.

Advantageously the adaptor can include a third light pathway between the third part of the first housing and the third part of the second housing, said pathway being arranged to enable light emitted from the third fibre optic connector assembly in the second housing to be transmitted to the third part of the first housing. The third shutter member is arranged to block the light escaping from the first housing.

Advantageously the adaptor can include a fourth light pathway between the fourth part of the first housing and the fourth part of the second housing, said pathway being arranged to enable light emitted from the fourth fibre optic connector assembly in the second housing to be transmitted to the fourth part of the first housing. The fourth shutter member is arranged to block the light escaping from the first housing.

At least one of, and preferably each of, the shutter members, the first housing and the second housing are made from a plastics material.

An embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is an isometric exploded view of a first embodiment of the invention;

Figure 2 is an enlarged isometric view of a first housing, which is included in the first embodiment;

Figure 3 is an end view of the first embodiment looking at a second housing, which is included in the first embodiment;

Figure 4 a side sectional view along the line A-A shown in Figure 3; and

Figure 5 is an enlarged isometric view of a spring unit, which is included in the first embodiment.

Figure 1 shows an adaptor 1 for fibre optic connector assemblies in accordance with the invention. The adaptor 1 includes first and second housings 3,5 that are ultrasonically welded together.

The first housing 3 is arranged to receive four fibre optic connectors (not shown), arranged in a two-by-two array. The first housing 3 includes a first part 3a for receiving a first fibre optic connector, a second part 3b for receiving a second fibre optic connector, a third part 3c for receiving a third fibre optic connector and a fourth part 3d for receiving a fourth fibre optic connector (see Figure 2).

The first housing 3 is also arranged to receive duplex type connectors. For example, a first duplex type connector can fit into the first and third parts 3a,3c simultaneously. A second duplex type connector can fit into the second and fourth parts 3b,3d simultaneously. This provides a versatile housing 3.

The first housing 3 has an open end 7, side walls 9,11, central partition 13, upper and lower walls 15,17 and a mounting end 19, which includes an end wall 21.

The first housing 3 includes four shutter elements 23,25,27,29. Each shutter element 23,25,27,29 includes pivot pins 31 and is pivotally attached to the first housing 3 via recesses 33 formed in the housing. Each shutter element 23,25,27,29 snap fits to the first housing. The shutter element 23 is pivotally attached to the first housing 3 via the side wall 9 and the central partition 13, and is located in the first part 3a. The shutter element 25 is pivotally attached to the side wall 9 and the central partition 13, and is located in the second part 3b. The shutter element 27 is pivotally attached to the central partition 13 and to the side wall 11, and is located in the third part 3c. The shutter element 29 is pivotally attached to the central partition 13 and side wall 11, and is located in the fourth part 3d.

Thus each shutter element 23,25,27,29 is arranged to move independently of the other shutter elements.

The shutter element 23 is mounted above the shutter element 25. The shutter element 27 is mounted above the shutter element 29. The shutter element 23 is mounted adjacent shutter element 27 in a side-by-side relationship. The shutter element 25 is mounted adjacent shutter element 29, in a side-by-side relationship. The shutter elements 23,25,27,29 are arranged in a two-by-two array when looking at the open end 7.

Each shutter element 23,25,27,29 has a closed (resting) position that is inclined to its respective insertion axis (Figure 4 shows the insertion axes Z-Z and Y-Y for the first and second parts 3a,3b respectively).

The shutter elements 23,27 are pivotally attached to the housing at their lower ends. The shutter elements 25,29 are pivotally attached to the housing at their upper ends.

The side walls 9,11 and central partition 13 each include a slot 35,37,39 formed therein. The slots 35,37,39 are arranged to receive a spring unit 41. The spring unit 41 extends across the width of the first housing 3 and separates the first part 3a from the second part 3b, and the third part 3c from the fourth part 3d.

The spring unit 41 includes a body 43 and four spring elements 45,47,49,51. The spring elements 45,47,49,51 are arranged to bias their respective shutter elements 23,25,27,29 to their closed positions.

The body 43 includes an upper member 53 and lower member 57. The upper and lower members 53,57 are arranged substantially parallel to one another. Each of the upper and lower members 53,57 is substantially planar. The upper and lower members 53,57 are connected by an end wall 59. The body 43 is open at a front end 73.

The spring elements 45,49 are inclined to the upper member 53 when in a non-loaded condition. The spring elements 45,49 are each cantilevered to the upper member 53 towards the end wall 59. The spring elements 45,49 protrude upwards out of the plane of the upper member 53 into the first and third connector receiving parts 3a,3c respectively. The free ends 45a,49a of the spring elements curve downwards towards the upper member 53.

The spring elements 47,51 are inclined to the lower member 57 when in a non-loaded condition. The spring elements 47,59 are each cantilevered to the lower member 57 towards the rear wall 59. The spring elements 47,51 protrude downwards out of the plane of the lower member 57 into the second and fourth connector receiving parts 3b,3d respectively. The free ends 47a,51a of the spring elements curve upwards towards the lower member 57.

Thus each spring element 45,47,49,51 comprises a tongue that protrudes out of the plane of its respective member 53,57 when in its resting orientation.

When viewed in plan, the spring element 45 is positioned over the spring element 47 and the spring element 49 is positioned over the spring element 51. When viewed from the side, the spring elements 45 and 49 are each inclined to the upper member 53 such that the separation from the upper member 53 increases in a direction from the rear end 59 to the leading end 73. When viewed from the side, the spring elements 47 and 51 are each inclined to the lower member 57 such that the separation from the lower member 53 increases in a direction from the rear end 59 to the leading end 73.

The spring unit 41 is substantially symmetrical on either side of a central vertical plane. The spring unit 41 is substantially symmetrical on either side of a central horizontal plane.

The spring unit 41 is made from sheet material. The spring unit 41 is integrally formed, for example it can be made from a single piece of sheet material that is bent into shape. Preferably the spring unit is made from spring steel.

The edges 61,63 of the upper member 53 are bent downwards. The edges 65,67 of the lower member 57 are bent upwards. The edges 61,65 define a slot 69 therebetween. The edges 63,67 define a slot 71 therebetween. The edges 61,65 have cutaway sections 61a,65a and the edges 63,67 have cutaway sections 63a,67a, each located towards the open end 73.

A trim element 75 is provided. The main purpose of the trim element 75 is to prevent the upper and lower members 53,57 from moving towards one another (collapsing) when the connectors are inserted into the housing 3. It also ensures that the load applied to each shutter element 23,25,27,29 is provided by its respective spring element 45,47,49,51 rather

than the upper and lower members 53,57. The trim element 75 includes two parallel arms 76,78 and a cross-piece 77 that connects the parallel arms 76,78 together. Each arm fits into one of the slots 35,37 in the side walls 9,11. The trim element 75 includes internal ribs 79 that are arranged to protrude into the slots 69,71 formed by the spring edges 61,65,63,67, and the open end 73 of the spring unit 41. The ribs 79 prevent the upper and lower members 53,57 moving towards each other when connectors are inserted.

The cross-piece 77 can be used to display information, such as technical data, a label, a company logo, etc. The trim element 75 also provides an aesthetically pleasing look since it hides part of the spring unit 41 from view.

Each shutter element 23,25,27,29 includes an abutment 26 on a rear face that is arranged to engage with the free end 45a,47a,49a,51a of its respective spring element 45,47,49,51. The abutment 26 ensures that the shutter element 23,25,27,29 sits in its fully closed position after a long period of use, for example when some spring element 45,47,49,51 fatigue may occur.

When a fibre optic connector is pushed into the first housing 3, it engages its respective shutter element 23,25,27,29 and forces the shutter element 23,25,27,29 upwards (in the case of shutter elements 25,29) or downwards (in the case of shutter elements 23,27) against the resiliency of the respective spring element 45,47,49,51. When the fibre optic connector is fully inserted into the first housing 3, the respective shutter element 23,25,27,29 lies substantially parallel with the insertion axis of the fibre optic connector and the respective spring element 45,47,49,51 is urged into the plane of its respective body member 53,57. When the fibre optic connector is removed, the resiliency of the spring element 45,47,49,51 urges the shutter element 23,25,27,29 back to its closed position.

Each of the shutter elements 23,25,27,29 includes a recess 22 formed in its outer face 24. The recesses 22 are arranged to prevent the leading end of the fibre optic cable, which typically includes a ferrule, from contacting the shutter elements 23,25,27,29 as the fibre optic connectors are pushed into the first housing 3.

The second housing 5 is similar to the first housing 3 except that it does not include any shutter elements 23,25,27,29 or a spring unit 41. The second housing 5 includes an outer

spring unit 81 that is arranged to attach the second housing 5 to some other member, such as a panel. The outer spring unit 81 is detachable from the second housing 5. The outer spring unit 81 sits in a recess 89 formed in an outer surface of the second housing 5.

The first and second housings 3,5 are connected together via their mounting ends 19. The first and second housings 3,5 include locating formations 87 to align the first and second parts of the housing 3,5 when connecting them together.

The end walls 21 of the housings 3,5 include four through holes 83 arranged in a two-by-two array. When the first and second housings 3,5 are attached together, the holes 83 formed in the first housing 3 are aligned with the holes 83 formed in the second housing 5. Alignment sleeves 85 protrude into the first and second housings 3,5 via the holes 83, which control the mating faces of connector ferrules. A first alignment sleeve 85 connects the first connector receiver parts 3a,5a together, a second alignment sleeve 85 connects the second connector receiver parts 3b,5b together, a third alignment sleeve 85 connects the third connector receiver parts 3c,5c together and a fourth alignment sleeve 85 connects the fourth connector receiver parts 3d,5d together. The alignment sleeves 85 provide pathways for light to be transmitted between corresponding fibre optic cable assemblies inserted into corresponding parts of the first and second housing 3,5.

Preferably all of the components, apart from the springs 41,81 are made from a plastics material, with the exception of the alignment sleeves 85, which are preferably made from ceramic zirconia.

In use, up to four fibre optic connector assemblies can be inserted into the second housing 5, via the open end 7, one into each of the first, second, third and fourth fibre optic connector receiving parts 5a,5b,5c,5d of the housing.

Up to four fibre optic connector assemblies can be inserted into the first housing 3 via the open end 7, one into each of the first, second, third and fourth fibre optic connector receiving parts 3a,3b,3c,3d.

Each fibre optic connector receiving part 3a,5a of the first and second housings 3,5 includes formations, such as ribs and recesses that are arranged to engage with complementary formations on the fibre optic connector in order to properly align the

leading end of the connector, which typically includes a ferrule, with the respective alignment sleeve 85. For example, a first fibre optic cable assembly inserted into the first part 3a of the first housing 3 is aligned with a first fibre optic cable assembly inserted into the first part 5a of the second housing 5. The sleeve 85 receives the connector ferrules and aligns them the arrangement is such that light can be communicated between the first fibre optic cable assemblies via the alignment sleeve 85.

If the first fibre optic cable assembly is removed from the first housing 3, light from the corresponding first fibre optic cable assembly in the second housing 5 is prevented from leaking out of the open end 7 of the first housing 3 by the shutter element 23. This is because, on removal of the first fibre optic cable assembly from the first housing 3, the spring element 45 urges the shutter element 23 to the closed position, which blocks and/or diffuses the light transmitted into the first housing 3 by the corresponding first fibre optic cable assembly located into the second housing 5.

This general arrangement and mode of operation applies to the other shutter members 25,27,29 and the respective fibre optic cable assemblies.

The above operation also applies when duplex type connectors are inserted into the housing. In that case, a duplex type connector simultaneously acts on a pair of shutter members, for example shutter members 23 and 27, or shutter members 25 and 29.

It will be apparent to the skilled person that modifications can be made to the above embodiment that fall within the scope of the invention, for example instead of having a two-by-two array (two columns, two rows) other configurations are possible, such as one column two rows, three columns by two rows, four columns by two rows, and adapting the spring unit accordingly. For an embodiment having one column and two rows only half of the spring unit 41 is required, for example the spring unit 41 can be split along a centre line so that the unit includes only the spring elements 45 and 47.

It will be appreciated that additional spring units can be added to increase capacity, for example embodiments having two columns and four rows include two spring units, one between each pair of rows.

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The first and second housings can be arranged to receive different types of fibre optic connectors.

Optionally, at least one of the shutter elements 23,25,27,29 can be translucent. This enables fault detection by attaching the fibre optic connector assembly attached to the second housing 5 to a red light source. The translucency of a shutter element enables the red light source to be more easily seen and therefore it is easier to identify that the light is being correctly transmitted by the fibre optic connector assembly attached to the second housing 5.

Claims

1. An adaptor for fibre optic cable assemblies, said adaptor including:
 - a first housing arranged to receive a plurality of fibre optic connectors, said first housing including a first part for receiving a first fibre optic connector and a second part for receiving a second fibre optic connector;
 - a first shutter member arranged to pivot relative to the first housing between closed and open positions in response to insertion of the first fibre optic connector along a first insertion axis;
 - a second shutter member arranged to pivot relative to the first housing between closed and open positions in response to insertion the second fibre optic connector along a second insertion axis;
 - a spring unit including a first spring member arranged to bias the first shutter member to a closed position and a second spring member arranged to bias the second shutter member to a closed position.
2. An adaptor according to claim 1, wherein the first shutter member is inclined to the first insertion axis when in its closed position; and the second shutter member is inclined to the second insertion axis when in its closed position.
3. An adaptor according to claim 1 or 2, wherein the spring unit is located between the first and second parts of the housing.
4. An adaptor according to any one of the preceding claims, wherein the first housing includes at least one slot and the spring unit is located in the at least one slot.
5. An adaptor according to claim 4, wherein the spring unit is arranged to slide into the or each slot.

6. An adaptor according to any one of the previous claims, wherein the spring unit includes a body and each of the first and second spring members is cantilevered to the body.
7. An adaptor according to claim 6, wherein the first and second spring members are cantilevered to a rear part of the body.
8. An adaptor according to any one of the preceding claims, wherein the first spring member is inclined to the body when the first shutter member is in its closed position.
9. An adaptor according to any one of the preceding claims, wherein the second spring member is inclined to the body when the second shutter member is in its closed position.
10. An adaptor according to any one of the preceding claims, wherein the first and second spring members are arranged opposite to one another.
11. An adaptor according to any one of the preceding claims, wherein the first spring member protrudes into the first part of the first housing, and the second spring member protrudes into the second part of the first housing.
12. An adaptor according to any one of the preceding claims, wherein the spring body is substantially U-shaped in section.
13. An adaptor according to any one of the preceding claims, wherein the spring unit is made from sheet material.
14. An adaptor according to any one of the preceding claims, wherein the spring unit comprises an integral unit.
15. An adaptor according to any one of the preceding claims, wherein at least one of the spring members includes a profiled engagement end that is arranged to engage a formation on its respective shutter member.

16. An adaptor according to claim 15, wherein each of the spring members includes a profiled engagement end that is arranged to engage a formation on its respective shutter member.
17. An adaptor according to any one of the preceding claims, wherein the spring unit includes first and second body members connected together by an end wall, and the adaptor includes at least one support element for preventing the first and second body members from collapsing together when a connector is inserted.
18. An adaptor according to any one of the preceding claims, wherein at least one of the shutter members is pivotally attached to the first housing.
19. An adaptor according to claim 18, wherein each of the shutter members is pivotally attached to the first housing.
20. An adaptor according to any one of the preceding claims, at least one of the shutter members includes a recess in an outer face that is arranged to prevent a ferrule attached to its respective fibre optic connector from coming into contact with an outer face of the shutter member.
21. An adaptor according to claim 20, wherein each shutter member includes a recess in an outer face that is arranged to prevent a ferrule attached to its respective fibre optic connector from coming into contact with an outer face of the shutter member.
22. An adaptor according to any one of the preceding claims, wherein the first housing includes a third part arranged to receive a third fibre optic connector, and a fourth part arranged to receive a fourth fibre optic connector.
23. An adaptor according to claim 22, including a third shutter member arranged to pivot relative to the first housing between closed and open positions in response to insertion of the third fibre optic connector along a third insertion axis; a fourth shutter member arranged to pivot relative to the first housing between closed and open positions in response to insertion the fourth fibre optic connector along a fourth insertion axis; wherein the spring unit includes a third spring member

arranged to bias the third shutter member to a closed position and a fourth spring member arranged to bias the fourth shutter member to a closed position.

24. An adaptor according to claim 23, wherein the spring unit is located between the third and fourth parts of the housing.
25. An adaptor according to claim 23 or 24, wherein the first housing includes a central partition and the spring unit is located in slots formed in the central partition and the first and second side walls.
26. An adaptor according to any one of claims 23 to 25, wherein each of the third and fourth spring members is cantilevered to the body.
27. An adaptor according to claim 26, wherein each of the third and fourth spring members is inclined to the body in a rest position.
28. An adaptor according to claim 27, wherein each of the third and fourth spring members is cantilevered to the rear part of the body.
29. An adaptor according to any one of claims 23 to 28, wherein the third and fourth spring members are arranged opposite to one another.
30. An adaptor according to any one of claims 23 to 29, wherein the third spring member protrudes into the third part of the first housing, and the fourth spring member protrudes into the fourth part of the first housing.
31. An adaptor according to any one of the preceding claims, including a second housing.
32. An adaptor according to claim 31, wherein the second housing is ultrasonically welded to the first housing.
33. An adaptor according to claim 31 or 32, wherein the second housing is arranged to receive a plurality of fibre optic connectors, said second housing including a first part arranged to receive a first fibre optic connector along the first insertion axis that when located in-situ is substantially axially aligned with the first fibre optic connector of the first housing; and a second part arranged to receive a second fibre

optic connector along the second insertion axis that when located in-situ is substantially axially aligned with the second fibre optic connector of the first housing.

34. An adaptor according to claim 33, wherein the second housing includes a third part arranged to receive a third fibre optic connector along the third insertion axis that when located in-situ is substantially axially aligned with the third fibre optic connector of the first housing; and a fourth part arranged to receive a fourth fibre optic connector along the fourth insertion axis that when located in-situ is substantially axially aligned with the fourth fibre optic connector of the first housing.
35. An adaptor according to claim 33 or 34, including a first light pathway between the first part of the first housing and the first part of the second housing, said pathway being arranged to enable light emitted from the first fibre optic connector assembly in the second housing to be transmitted to the first part of the first housing; and a second light pathway between the second part of the first housing and the second part of the second housing, said pathway being arranged to enable light emitted from the second fibre optic connector assembly in the second housing to be transmitted to the second part of the first housing.
36. An adaptor according to claim 35, including a third light pathway between the third part of the first housing and the third part of the second housing, said pathway being arranged to enable light emitted from the third fibre optic connector assembly in the second housing to be transmitted to the third part of the first housing; and a fourth light pathway between the fourth part of the first housing and the fourth part of the second housing, said pathway being arranged to enable light emitted from the fourth fibre optic connector assembly in the second housing to be transmitted to the fourth part of the first housing.
37. An adaptor according to any one of the preceding claims, wherein at least one of the shutter members, and the first and second housings are made from a plastics material.

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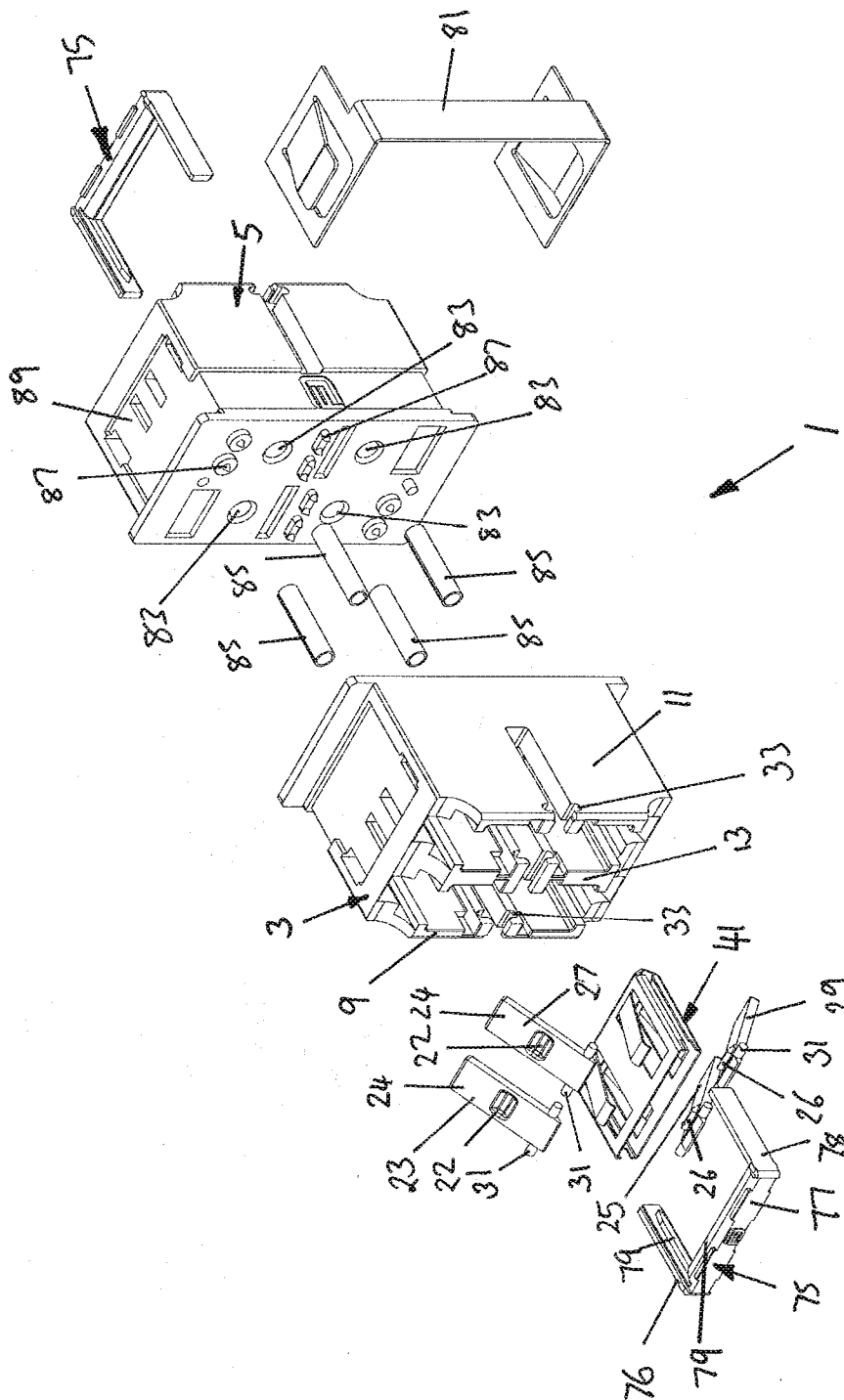
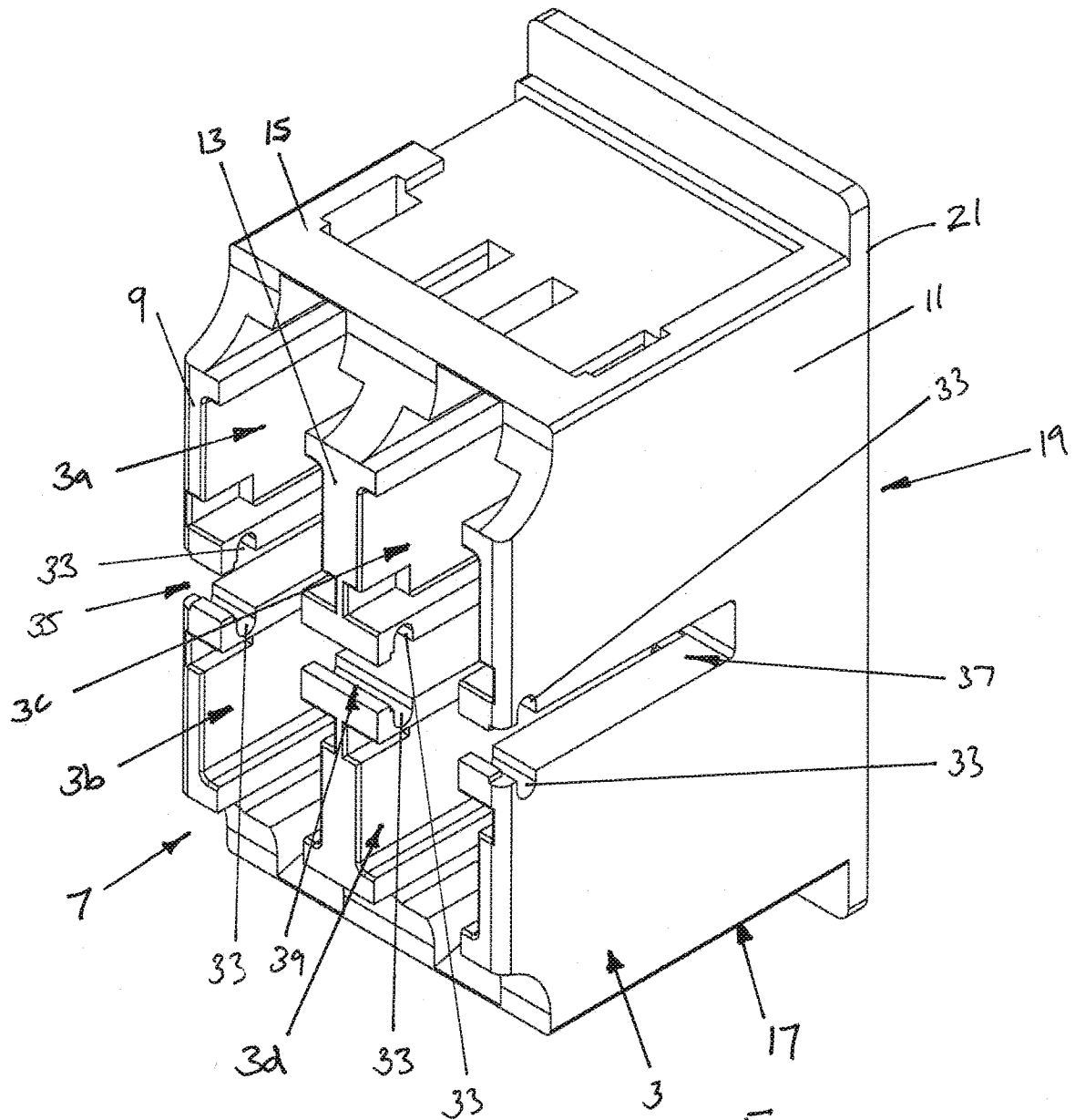
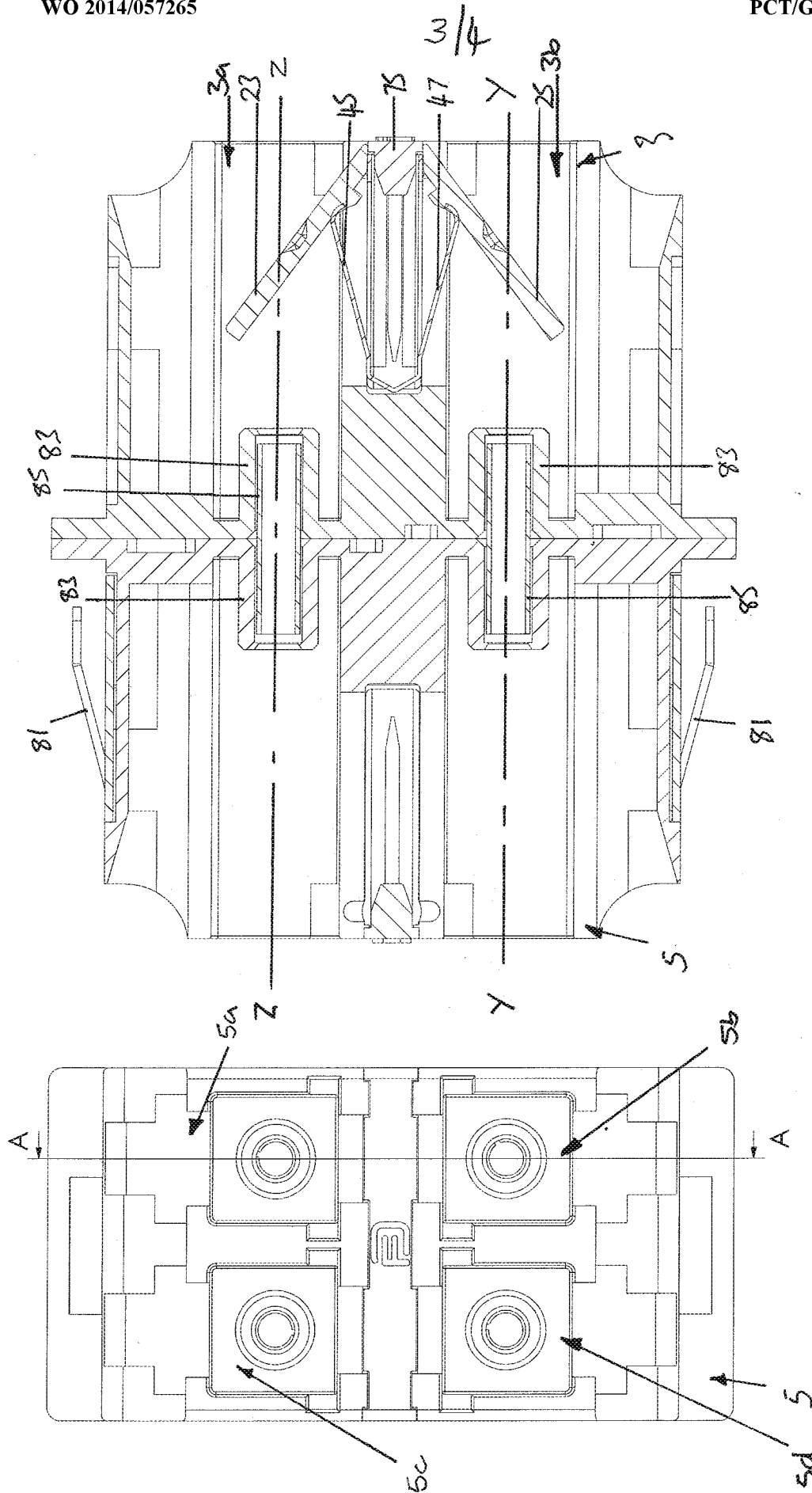


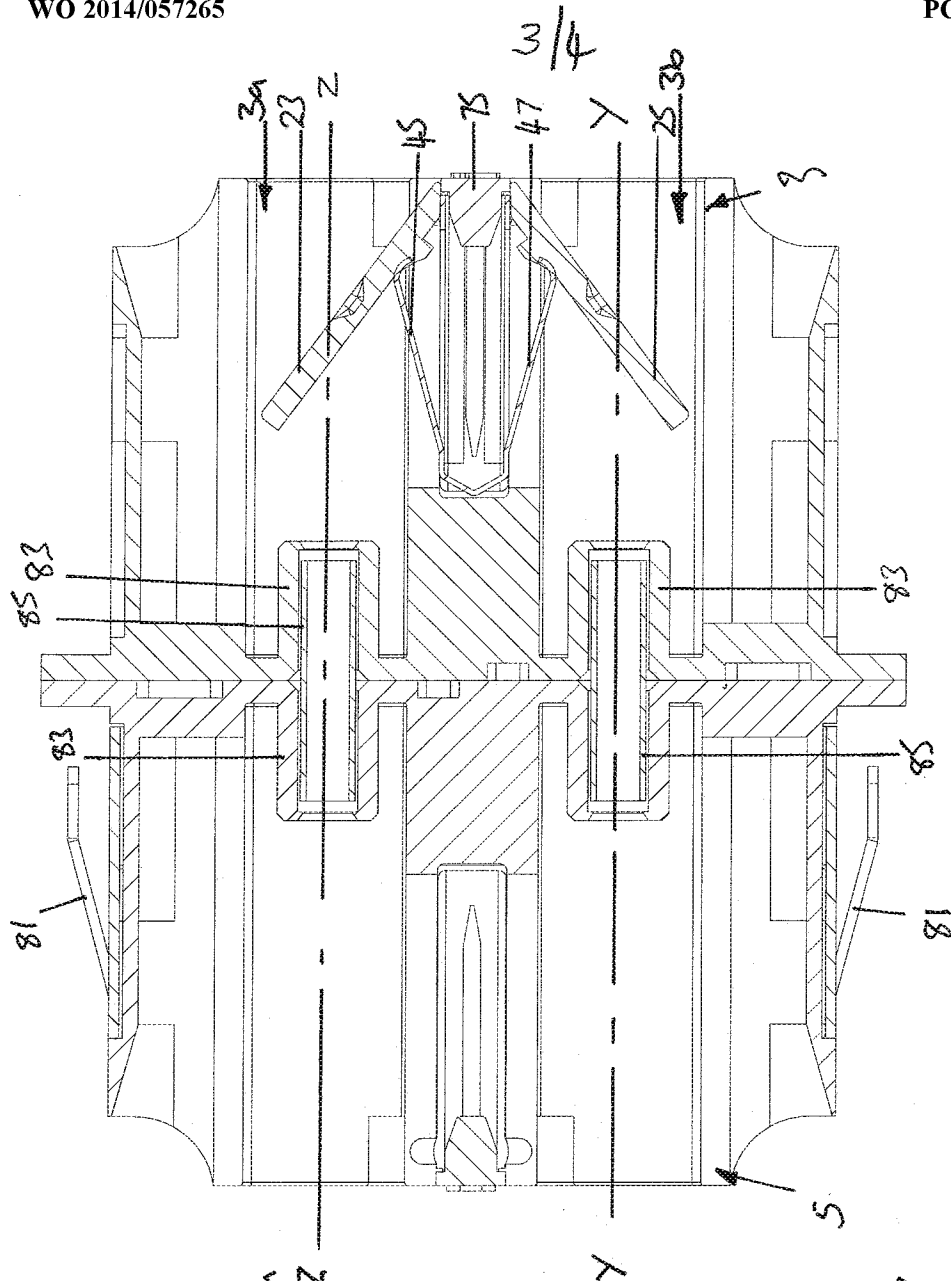
Fig. 1

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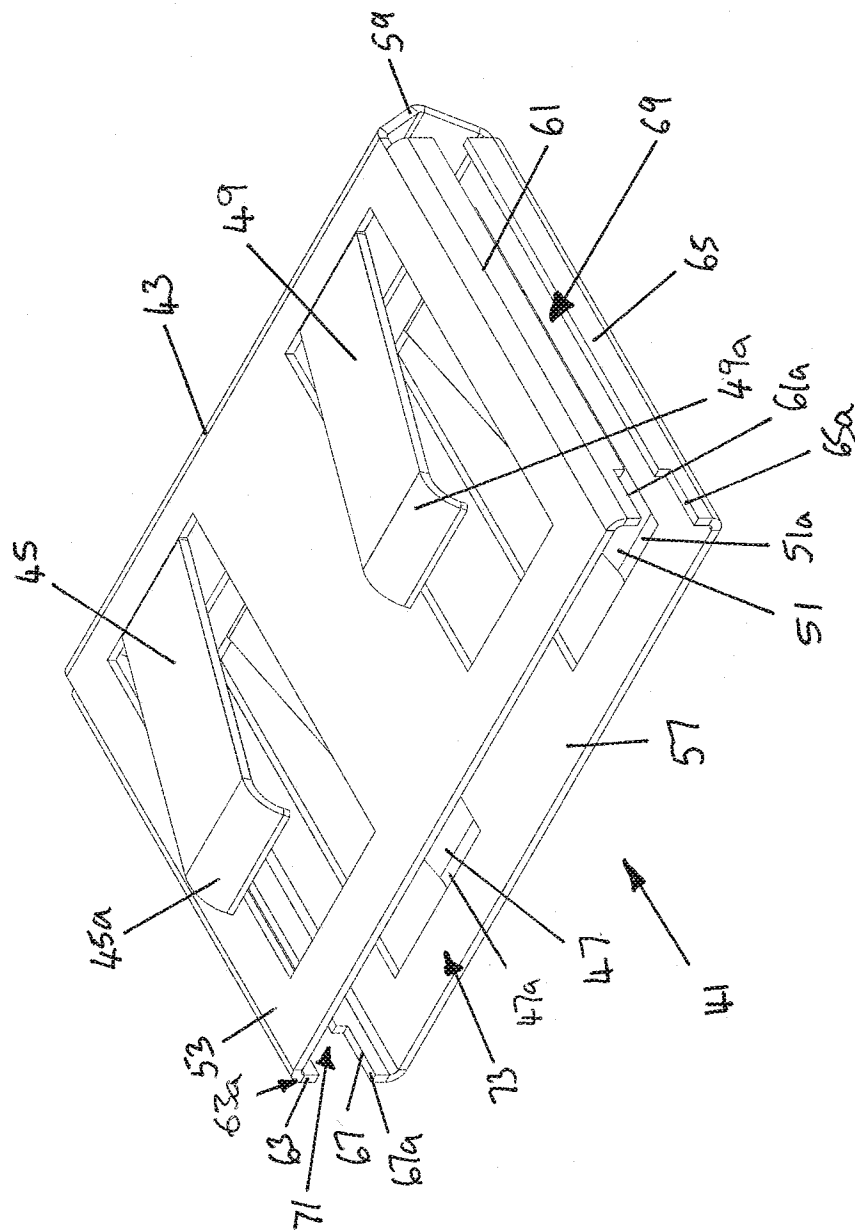


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SECTION A-A



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