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Research Report

Low profile multi channel optical connector

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1. Background

MPO standard connector for fiber array using MT ferrule has been proposed for multi-channel highly parallel optical interconnection for servers and workstations as well as communication systems. We are planning to use same mechanical format for highly parallel waveguide connector. This connector is designed to mate two MT ferrules together with latch and release mechanism. The facets of the two ferrules that should be connected are applied certain pressure by springs built in MPO housings. This mechanism takes certain volume and length to make MPO housing to be as long as about 23mm, for example, excluding boots to prevent fiber bundle to be bent with a steep angle. Figure 1-1 shows the structure of the standard MPO connector modified to be applied for the waveguide.

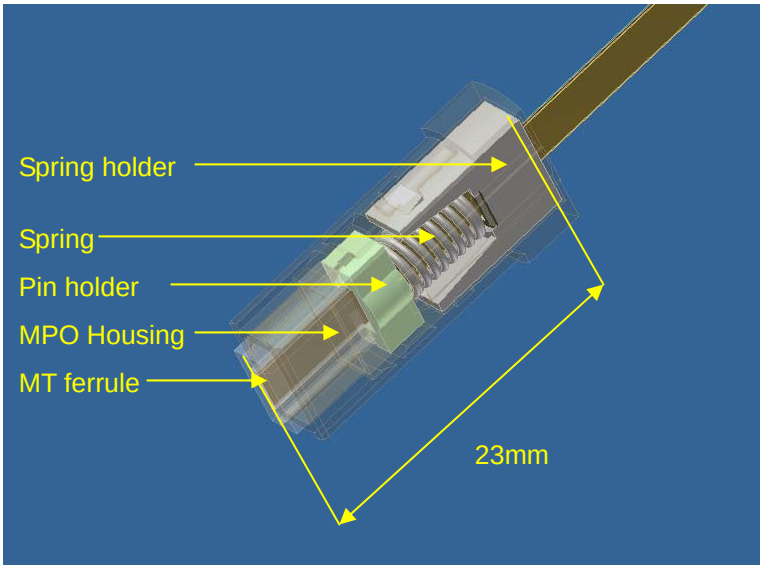

Figure 1-1

Connector is made of components inside the MPO housing as listed below:

1. MT ferrule with fiber bundle or waveguide array
2. (Alignment pins)
3. Pin holder
4. Spring
5. Spring holder (and spring base plate)

Springs in each MPO connector body apply enough pressure to realize low connection loss of a butt coupling. Spring is placed around the array of fibers or waveguide array, normally has a width of about 3mm. Therefore the size of the spring is about 3mm inner diameter. The length of the spring is about 10mm when it is free from stress, and 6.2mm when compressed with force of about 1Kgf.

This structure is optimized for single layer array with maximum of 12 fibers or waveguides. This dimension is not suitable for stacked fiber array or stacked waveguide arrays because the inner diameter of the spring is too tight or smaller for stacked fibers or waveguides when they are stacked, as shown in Figure 1-2. The length of the MPO connector should be relatively long because of the spring holder and a base plate required fixing the spring. Also, there is a chance to break the edge of the waveguide during the assembly process to insert the waveguide sheet into the inner side of the spring.

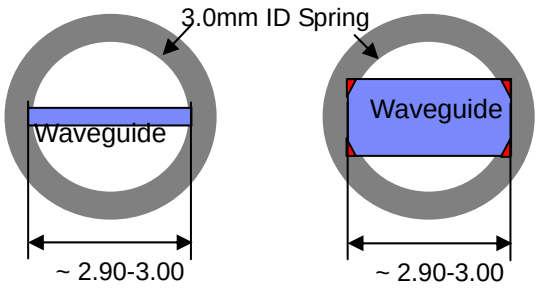

Figure 1-2

2. Conventional MPO connector

Figure 2-1 shows a conventional MPO connector parts, and Figure 2-2 and 2-3 explains the assembly process of MPO connector. Insertion of the spring (and other components) is necessary at the first step of the assembly. This procedure sometimes is inconvenient when both end of the fiber ribbon or the waveguide required having connectors.

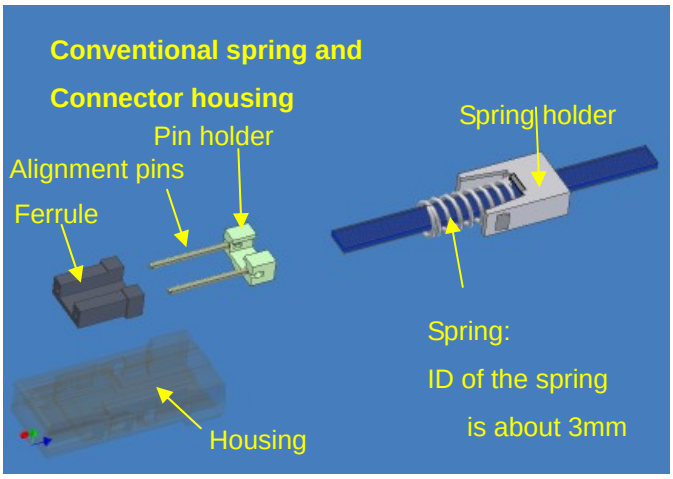

Figure 2-1

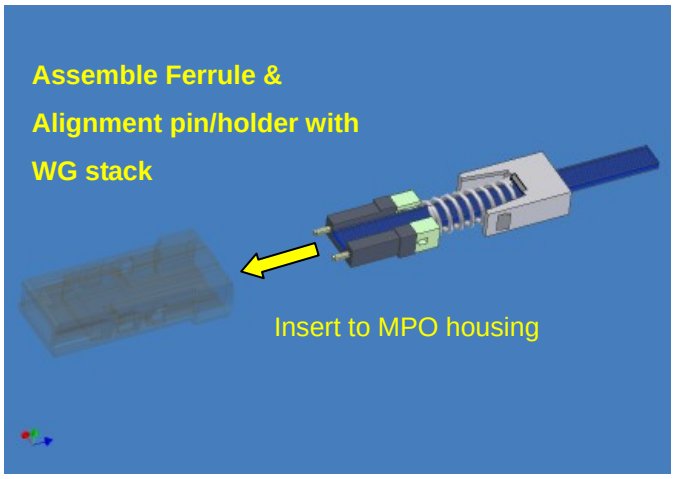

Figure 2-2

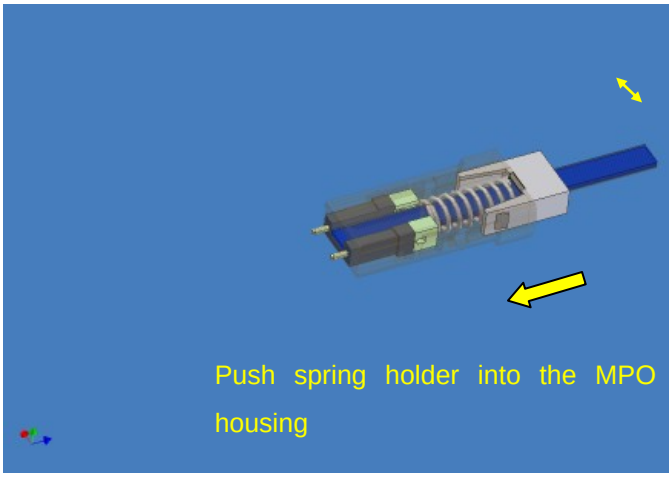

Figure 2-3

Assembly process sometimes has a risk to damage the edge of the waveguide or the fiber array, because the inner diameter of the spring is not large enough to insert the fiber array or the waveguide especially when they are stacked.

3. Low profile multi-channel optical connector

Figure 3-1 is a structure of the connector using a pair of springs of this new idea. Springs with very small diameter are used, replacing a relatively large single spring. Compression force constant of

the conventional spring and the spring of this idea could be almost the same according to our test result by using two springs. However the spring with very small diameter requires a support from bending when compressed. Structure of this new design does not require extra components but extend the alignment pins as a shaft to support the springs from bending. The inner diameter of the spring is made lager than the diameter of the alignment pins so that the spring is inserted to the extension of the alignment pins. Figures 3-2 to 3-4 show the assembly process and the 3-1 shows a connector assembly.

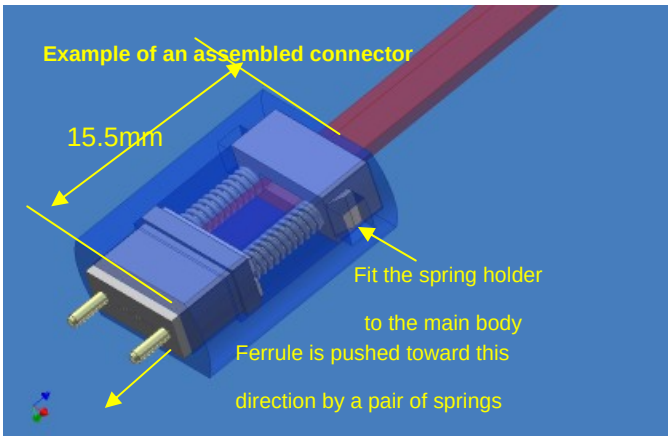

Figure 3-1

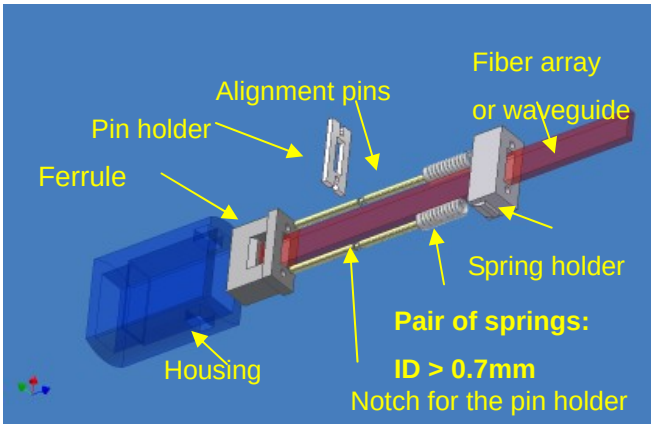

Figure 3-2

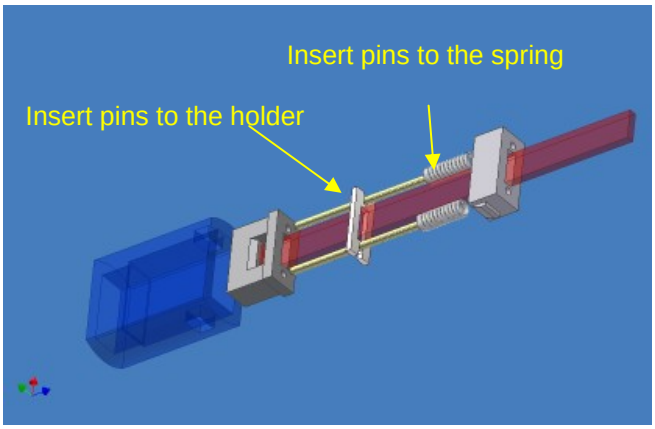

Figure 3-3

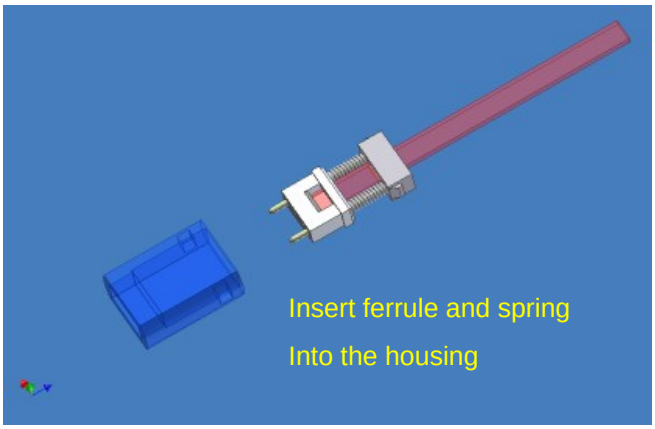

Figure 3-4

By making slots for fiber array or a waveguide to the pin holder and spring holder, it is no longer necessary to insert those components prior to the connector assembly. This makes assembly process much easier than a conventional connector.

This arrangement of the spring is effectively reduce the risk of waveguide edge damage during the assembly process.

Arrangement of two springs gives more uniform pressure at the ferrule facet than a single spring, in principle.

The author tested the spring of this diameter and length to have almost the same spring constant as a conventional spring.

3. Conclusion

This design requires no extra number of components in addition to the conventional connector.

Short length of the connector is very important for the connector to be used for the back plane of the computer system, for example.

1. It is easier to assemble especially when it is necessary to assemble two connectors in both end of the fiber array or the waveguide array.
2. It is more durable and reduces a risk of waveguide or fiber array damage during the assembly process or in use because the clearance of the spring and the waveguide or the fiber bundle edge is larger in a limited space inside the connector housing.
3. Connector profile is shorter (15.5mm) than conventional MPO connector (23mm). It is very important for the use in a server or computer because of the limited space and requirement of much more connectors to be packed in a limited real estate of the backplane.