

CONNECTOR

## FIELD OF THE INVENTION

5           The present invention relates to a connector intended to mate with a conjugate connector in order to link the first and second signal conduction means which terminate in each of said connectors, said connector comprising at least one body provided with a  
10 cylindrical bore designed to house an insert of cylindrical shape, said insert being equipped to receive each of the ends of the first signal conduction means and to connect them to the ends of the second signal conduction means, said insert being also  
15 provided with a base and with a first flange which are intended to allow it to be positioned on an insert support.

## PRIOR ART

20           Such connectors, making it possible to connect, mainly but not exclusively, electrical conductors or optical fibers or even a combination of the two, are well known and have to meet a very high quality of  
25 requirements especially with respect to the positioning of the insert. This is because the precise and stable position of the insert is a quality requirement of such connectors since they must allow the interpenetration of the male and female parts of said connectors with  
30 corresponding parts of the second connector. Incorrect

positioning inside the body of the insert or floating but uncontrolled positioning thereof, that is to say the angular and/or axial movement of the insert cannot be confined within predetermined limits, compromises the quality of the connection, especially when this is a connection comprising optical fibers, and prevents the apparatuses receiving the conducted signals from operating properly.

These connectors are used in several fields, such as civil and military aviation, various electronic appliances, etc, and have different dimensions depending on the use and especially on the power of the conducted signals. In the context of use in civil or military aviation in aircraft, these various elements are subjected to certain stresses, such as vibrations and sudden changes in acceleration, and they must always guarantee a continuous link between the corresponding conduction means.

The connectors used in the abovementioned applications are mainly of two types. A first type, called push-pull, comprising a male connector and a female connector, allow coupling between the two connectors by acting on an axially movable outer body of the male connector which makes it possible to control a locking bush, two connectors of conjugate type being locked together by pushing in one direction and being unlocked by pulling on said body. The other type relates to connectors which are coupled by other means, for example simple snap-fastening of one connector in the other or equivalent. In both cases, the precise angular and axial position of the insert and the absence of uncontrolled floating are required in order to make an easy and reliable connection.

Within the context of an electrical connector, the insert also provides an insulation function and often in this field this insert is called an insulator, even when its function is not necessarily to insulate, for example when the connection concerns only optical fibers.

Usually, the insert has a cylindrical shape and is provided with axial passages in which the rods and/or bushes connected on the upline side to the ends of a cable or of the optical fibers are housed. This insert is provided with a base and with a flange which are housed in the insert holder. The insert holder consists of two semicylindrical shells which must at least partly match the insert and in order to position it with respect to these half-shells. For this purpose, a groove matches the base while the positioning flange is housed in a female element, especially a hole whose dimensions and shape correspond to the flange of the insert. One of the half-shells is also provided with a male element, often having the shape of an axial projection which engages in a corresponding female element, especially a notch, inside the connector body in order to angularly position the insert/insert holder assembly. The insert is thus firstly positioned with respect to the insert holder and then the insert holder ensures that the assembly is centered inside the body of the connector. Complementary elements, such as washers and/or seals, together with a clamping means for example for the cable, and a nut or collet nut ensure axial retention of the insert/insert holder assembly on the upline side.

This type of insert holder has a number of drawbacks relating to the centering and the mounting of the connector: firstly, the two half-cylinders are manufactured by screw-machining, for cost reasons since this type of connector must not be expensive, and the manufacturing tolerances mean that the half-shells added around the insert either do not form a complete cylinder, and the shells float in an uncontrolled manner, or they are slightly greater than a half-shell, to the detriment of proper retention of the insert in its support. Thus, upon installation inside the body under the abovementioned conditions, the insert holder is not positioned precisely and there may be a clearance with respect to the insert holder, that is to

say it may float, without this floating being able to be controlled, something which may have unfortunate consequences when linking two connectors together. In addition, particular care must be taken when mounting, 5 in order to choose shells which correspond as best as possible, thereby increasing the labor cost, and it has an impact on the manufacturing cost of the connector. Moreover, mounting the insert in its support and then inside the body requires several handling operations 10 and often the insert floats, beyond the permissible limits because of the manufacturing tolerances on its support, under the thrust of the cable, which may put it in a skew position and result, when coupling it to the corresponding connector, in a poor connection or 15 even deform the male and female parts involved.

#### SUMMARY OF THE INVENTION

The object of the present invention is to 20 propose connectors, whether of the push-pull type or not, which are provided with an insert and with an insert holder allowing the abovementioned drawbacks to be eliminated.

The connector according to the invention is one 25 wherein the insert is provided with a second flange which ensures that it is positioned angularly in said body so as to mate with a conjugate female element of said body, wherein said body has a shoulder against which the insert can bear via one of the radial walls 30 of the base which positions it axially in the body and wherein the insert support is a piece formed from a hollow cylindrical part whose outside diameter corresponds to the diameter of the bore of said body followed by a cylindrical wall which extends over a 35 peripheral length greater than a peripheral half-length, said wall being divided into two parts by an axial guiding groove with which the first flange of the insert mates.

The advantages of the connector according to the invention, and more particularly of the insert and the insert support, are the following:

the insert is virtually identical to the  
5 inserts used up till now, apart from the second flange  
which allows the insert and the insert support to be  
angularly positioned inside the body mating with a  
female element of said body. Thus, the angular  
positioning of the insert inside the body depends no  
10 longer on the screw-machining manufacture of the insert  
support but on the manufacturing tolerances on the  
insert which are much more precise and easy to meet.  
Retention of the insert by the insert support, and the  
fitting of it into the support, are very easy since all  
15 that is required is to insert the insert into the  
approximately cylindrical opening formed by the  
cylindrical wall, taking care to slide the first  
positioning flange in the groove provided for this  
purpose. Thus, it is very easy to mount the insert in  
20 the insert support and it does not require complicated  
manipulations. The limiting axial positioning of the  
insert on the insert support is provided by one of the  
radial walls of the base of the insert against the edge  
of the cylindrical wall.

25 In this case, the centering of the insert  
inside the body is achieved by the elements which are  
specific to it, namely the various bearing surfaces -  
those of the base and those of its downline part inside  
the body which has, of course, bores of corresponding  
30 diameter, and not by an accumulation of pieces as is  
the case with the abovementioned half-shells. The  
insert is no longer floating in an uncontrolled manner  
under the thrust of the cable or of the clamping  
system.

35 According to one embodiment, the hollow  
cylindrical part is provided on its outer surface with  
a guiding flange intended to mate with a conjugate  
female element located upline of said body. This  
flange, with which the hollow cylindrical part of the

insert support is provided, located upline and mating with the female element of the body, ensures the angular positioning of the insert support and at the same time reinforces the correct angular positioning of the insert.

According to one embodiment, the two parts of the cylindrical wall are designed to pinch the insert elastically, that is to say this wall is slightly conical, which is easy to obtain since this cylindrical wall is made in two parts because of the groove. This also makes the manipulations during mounting easier since the insert is properly retained at the end of this cylindrical wall once the corresponding cylindrical part of the insert has been introduced into the cylindrical opening.

According to another embodiment, the insert support is provided on its cylindrical part with a slot into which a seal, for example an O-ring, can be placed, which makes it possible, when necessary, to ensure that the connector on the downline side is sealed and it is not necessary to provide a seal which has to be protected by a washer against the clamping of the nut or collet nut. In addition, there is no risk of this seal being lost when dismantling the connector.

When the connector is intended to be used for optical fibers, the insert support is provided on its upline part with a tubular part of smaller diameter, allowing the optical fiber or fibers to be entered and held in place, for example by injecting an adhesive or a similar product.

When the connector is of the push-pull type, the two female elements are located in the inner bush of this connector, which is in contact with the insert and also the insert support.

Finally, to prevent the insert from possibly being incorrectly positioned with respect to the insert support, the insert is provided with a flange of larger dimensions than those of the groove in the insert holder and placed so that it is not possible to mount

the insert on the insert support in an erroneous manner.

#### BRIEF DESCRIPTION OF THE DRAWINGS

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The invention will be described in more detail with the aid of the appended drawing.

Figure 1 is a partial sectional view of a male connector of the push-pull type designed to connect optical fibers.

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Figures 2 and 3 show the insert support from the side and in plan view.

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Figures 4 and 5 are two views of the insert according to the invention.

Figure 6 shows, in side view, an insert support provided for a connector which is not intended for connecting optical fibers.

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Figure 7 is a partial sectional view of a female connector of the push-pull type, corresponding to the male connector of figure 1.

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#### DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

The connector shown in figure 1 is composed of an inner bush 1 on which is mounted a locking bush 2 provided with three resilient projections 3 terminating in catches 4 having a slope 5 toward their downline ends. The locking bush 4 is surrounded by an outer body 6 provided with three windows 7 through which the catches 4 pass. The axial fastening in the downline direction of the connector, both of the locking bush 2 and the outer body 6, is provided by an attached ring 12 which fits onto the downline end of the inner bush 1. The attached ring 12 is fastened by any known means, e.g.

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screwing, punching, soldering, etc. The ring 12 has a shoulder 13 against which the downline end of the outer body 6 bears. The locking bush 2 butts against a shoulder 8 of the inner bush 1. The same shoulder 8  
 5 limits the axial movement of the outer body 6 in the direction of the arrow F. The attached ring 12 is fastened to the bush after the locking bush 2 and the outer body 6 have been fitted.

This type of push-pull connector is known and  
 10 for this reason a more detailed description is not necessary.

By moving the outer body 6 in the direction of the arrow F, the catches 4 are pushed radially toward the inside of the connector, and they are therefore  
 15 moved toward the inner bush 1, thereby allowing the connector to be disengaged from the conjugate connector. In order to fit the connector, all that is required is to push it into the corresponding conjugate connector and the slope 5 of the catches pushes them  
 20 inward until the catches 4 have been snap-fastened, that is to say until they are engaged in a corresponding groove of the conjugate connector.

The inner bush 1 has a bore 14. This bore has, toward the downline end, a narrowing 15, the diameter  
 25 of which corresponds to the outside diameter of an insert 16. The shoulder thus formed by the narrowing of the diameter of the bore is provided with a notch 17 in which a flange 18 of an insert 16, which will be described with the aid of figures 4 and 5, is  
 30 positioned. The insert 16 has a base 19 via which the insert 16 can be positioned against the shoulder created by the difference in the diameters of the bores 14 and 15, thus making it possible to set the limit of the axial position of the insert in the downline  
 35 direction of the connector. The flange 18 provides the angular positioning of the insert. Contact between the bearing surface 16a downline of the insert and the bore 15 ensures that the insert is centered without any floating or any uncontrolled floating.

The insert 16 is supported by an insert support 20, the various elements of which will be described with the aid of figures 3 and 4. The insert support 20 comprises a hollow cylindrical part 21 provided with a flange 22 which is housed in a notch 23 of the inner bush 1, thereby also making it possible to angularly position the insert support and hence the insert. This flange 22 may be omitted, depending on the use and on the dimensions of the connector, but its presence makes it easier for the insert/insert support assembly to be properly positioned. The insert support comprises a cylindrical wall 23 which extends a little more than half of a peripheral length and is located after the cylindrical piece 21. The wall 23 of the insert is separated by a groove 24 into two parts, this groove having a width equal to that of a first flange 25 of the insert 16. The downline end of the wall 23 butts against the radial wall of the base 19; thus, when the fastening nut or collet nut 26 is screwed onto a screw thread 27 of the inner bush 1, the insert is positioned both axially and angularly in a position in which it is stable and cannot float in an uncontrolled manner. The insert holder is provided, when necessary, with a slot 28 in which a seal 29 is housed.

The connector thus described, including the insert and the insert holder according to the invention, ensures that the insert is properly positioned since its positioning inside the bush 1 is provided by the bearing parts of various surfaces of the insert 16 inside the bore 15 and the shoulder, and its axial positioning, after the nut 26 has been fitted, is also provided and does not depend on the manufacturing tolerances on the insert support, but only on the insert 16.

The connector described relates to a fiber-optic connector and the upline part of the insert support is provided with a tube 30 having a smaller diameter than that of the cylindrical part 21. This tube 30 is provided with a hole 31 through which an

adhesive can be injected in order to fasten the optical fibers inside this tube, since it is not possible to use a clamp, as is the case with an electrical cable.

We will now describe in somewhat more detail the insert support and the insert with the aid of the drawings which follow.

The insert as shown in figures 4 and 5 is a cylindrical piece penetrated by cylindrical passages 32 (see figure 1) in which are housed rods and/or bushes allowing interconnection between conduction means terminating in a connector mating with corresponding elements of another connector. The insert 16 is provided with a base 19 and with a first positioning flange 25 allowing it to be positioned in the support. A second flange 18, in principle opposite the first, allows, as mentioned above, the insert to be angularly positioned inside the bush 1. The radial wall upline of the base 19 serves as a stop against the ends of the cylindrical wall 23 of the insert support 20 and the flange 25 allows the insert to be positioned angularly with respect to the insert support by being inserted into the groove 24 located in the cylindrical wall 23 of the support. For the purpose of preventing the insert from being incorrectly positioned in the insert support, a flange 34 is provided on its lateral wall. The distance between this flange 34 and the flange 25, as well as its dimensions, prevent the wall 23 from being able to be positioned erroneously with respect to the insert 16.

Shown in figures 2 and 3, seen from the side and from above, is an insert support on which the hollow part 21 followed by a slot 28 for the possible housing of a seal may be distinguished. The cylindrical wall 23 extends slightly more than half of a peripheral length and is separated into two parts by a groove 24. A flange 22 on the hollow part 21 ensures that the insert support is angularly positioned in the inner bush 1 by mating with the abovementioned notch 32. In order for the insert to be able to be properly retained

when it is at the downline end of the support, the two parts of the wall 23 are slightly conical toward the downline part in order to provide a pinching effect on the insert and to hold it in place during manipulations to mount the connector. The insert support 20 also comprises, between the tube 30 and the cylindrical part 21, a frustoconical transition surface 33 making it possible, by mating with a conjugate surface of the nut 26, to ensure correct axial clamping.

We have shown in figure 6 a piece similar to that in figure 2, except that in this case the connector is not provided for optical fibers; thus, the upline part of the insert support is not necessary. We have used the same reference numbers as for figure 2, but with the ' symbol. In this case, behind the cylindrical part 21', a cable clamp and a corresponding nut or collet nut, which is screwed onto the inner bush 1, are introduced.

Shown in figure 7 is a female connector intended to mate with the male connector of figure 1.

To identify the various parts of this connector, which are the same as those in figure 1, we have used the same reference numbers, but preceded by a 1. Thus, the insert support is labeled 120, the insert 116, etc. Of course, the insert does not have exactly the same dimensions, but it is joined to the insert support 120 and to the connector body 50 by the same means. The female connector has a body 50, a shoulder 51 in a bore 54 against which the insert 116 can bear via the radial surface of its base 119. A notch 52 in the body 50 allows the front flange 118 of the insert 116 to be positioned. The downline part of the connector 50 has a cylindrical part 57 having a diameter sufficient to allow the downline part of the male connector to be inserted. It also has a recess 58 allowing catches 4 on the male connector to be engaged and hence allowing the assembly to be locked. The insert and the insert support are assembled as in the case of the male connector.

The description has been given in relation to a connector of the push-pull type, but the same construction of the insert and of the insert holder is valid for a normal connector, except that the two female parts (notches) 17 and 23 of the bush are transferred to the body of the connector in order to allow the insert and the insert support to be angularly positioned. Of course, the inside of the body is provided with a bore having two different diameters in order to allow the insert to be axially positioned by the radial surface of its base.

CLAIMS

1. A connector intended to mate with a conjugate connector in order to link the first and second signal conduction means which terminate in each of said connectors, said connector comprising at least one body (1; 50) provided with a cylindrical bore (14; 54) designed to house an insert (16; 116) of cylindrical shape, said insert being equipped to receive each of the ends of the first signal conduction means and to connect them to the ends of the second signal conduction means, said insert (16; 116) being also provided with a base (19; 119) and with a first flange (25; 25') which are intended to allow it to be positioned on an insert support, wherein the insert (16; 116) is provided with a second flange (18; 118) which ensures that it is positioned angularly in said body (1; 50) so as to mate with a conjugate female element (17; 51) of said body (1; 50), wherein said body (1; 50) has a shoulder against which the insert (16; 116) can bear via one of the radial walls of the base (19; 119) and wherein the insert support (20; 20'; 120) is a piece formed from a hollow cylindrical part (21; 21'; 121) whose outside diameter corresponds to the diameter of the bore (14; 54) of said body (1; 50) followed by a cylindrical wall (23; 23'; 123) which extends over a peripheral length greater than a peripheral half-length, said wall (23; 23'; 123) being divided into two parts by an axial guiding groove (24; 24') with which the first flange (25; 25'; 125) of the insert (16; 116) mates.
2. The connector as claimed in claim 1, wherein the hollow cylindrical part (20; 20'; 120) is provided on its outer surface with a guiding flange (22; 22'; 122) intended to mate with a conjugate female element (27; 27'; 127) located upline of said body (1; 50).
3. The connector as claimed in either of claims 1 and 2, wherein the two parts of said cylindrical wall



(23; 23'; 123) of the insert support are designed to pinch the insert (16; 116) elastically.

4. The connector as claimed in one of claims 1 to 3, wherein the hollow cylindrical part (21; 21'; 121) of the insert support is provided with a slot (28; 28'; 128) for housing a seal (29; 129).

5. The connector as claimed in one of claims 1 to 4, characterized in that the insert support (20; 20'; 120) is provided on the upline end with a hollow cylindrical projection (30; 130) of smaller diameter than that of the hollow cylindrical part (21; 121) intended to receive the signal conduction means.

6. The connector as claimed in one of claims 1 to 5, wherein said connector is of the push-pull type and wherein said female elements (17, 23) of the body are located on the inner bush (1) of said connector.

7. The connector as claimed in one of claims 1 to 6, wherein the insert (16; 116) is provided on its lateral surface with a flange (34), the position and dimensions of which prevent the insert (16) from being incorrectly positioned with respect to the insert support (20; 20').