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MULTI-CONTACT SPLINED ELECTRICAL CONNECTOR

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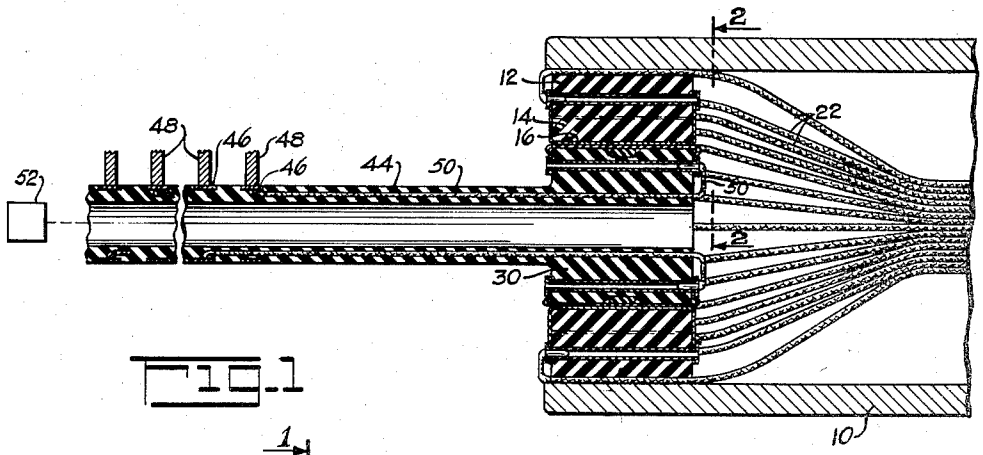


FIG. 1

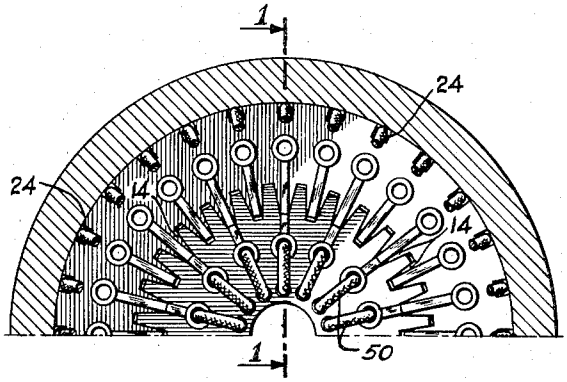


FIG. 2

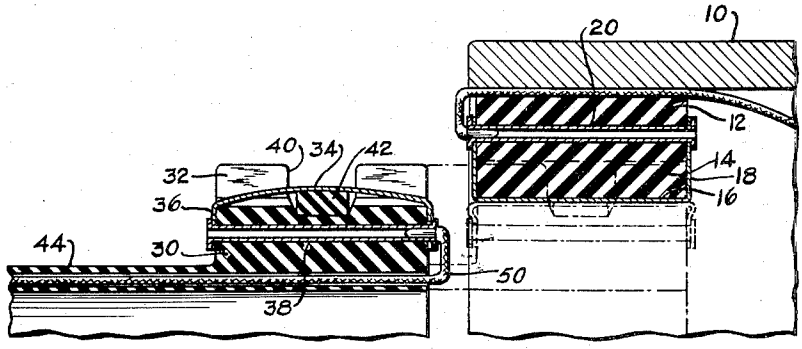


FIG. 3

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MULTI-CONTACT SPLINED ELECTRICAL CONNECTOR

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6 Claims. (Cl. 339—5)

This invention relates to electric connectors and is particularly directed to multi-contact electric connectors.

In testing modern aircraft engines it frequently is necessary to make a great many electrical connections in a rather limited space for example for transmitting thermocouple and strain gage measurements. An object of the present invention comprises the provision of a novel and simple separable electric connector for this purpose. It also is frequently necessary in such engine testing to make the electric connections through a rotating member. It is a further object of the invention to provide a multi-contact separable electric connector capable of transmitting substantial torque so that other devices may be driven therethrough.

In accordance with the invention the separable electric connector comprises a pair of members having mating axial splines with one of said members having contacts at the tips of its splines and the other having contacts at bases of its splines for engagement with said first mentioned splines.

Other objects of the invention will become apparent upon reading the annexed detailed description in connection with the drawing in which:

Fig. 1 is an axial sectional view on line 1—1 of Fig. 2 illustrating a connector embodying the invention;

Fig. 2 is a view taken along line 2—2 of Fig. 1; and

Fig. 3 is a partial view similar to Fig. 1 but showing the conenctor parts in their separated position but about to be connected together.

Referring to the drawing, reference numeral 10 designates a hollow rotatable shaft at one of which one part 12 of a multi-contact electric connector is co-axially secured within said shaft. The electric connector part 12 is made of electric insulating material and is held in position within the shaft 10 in any suitable manner for example as by a press fit between said parts and/or by means of set screws (not shown) carried by the shaft 10.

The electric connector part 12 has internal axially-extending splines 14 with each spline 14 having an electric contact strip 16 extending along the tip end of said spline preferably for the full length of said spline. The ends 18 of each such electric contact strip 16 are electrically connected to and are secured under the heads of a metallic tubular rivet-like member 20 which extends axially through the connector part 12. There is one such tubular rivet-like member for each contact strip 16. Electric wires 22 for transmitting electric signals, as from thermocouples or strain gages, have their ends electrically connected to said tubular rivet-like members 20 by plugging therein, each wire being connected to a different rivet-like member. If desired the ends of the wires 22 may be soldered to the members 20. Preferably each wire 22 is connected to the more accessible end of the connector part 12. For this purpose the connector part 12 has a plurality of grooves 24 extending axially-along and circumferentially-spaced about the periphery of said part. As illustrated there is one such

groove 24 for each wire 22. With this arrangement, the wires 22 can pass through the grooves 24 to the front of the connector part 12 for connection to their respective rivet members 20.

With the aforedescribed construction of the connector part 12, each wire 22 is electrically connected to one of the contact strips 16.

The mating electric connector part 30, also of insulating material, has external axially-extending splines 32 adapted to mate with the splines 14 of the part 12. Electric contact strips 34 are disposed between the splines 32, the contact strips extending along the bottoms or root portions of the inter-spline spaces. As illustrated the contact strips are only disposed in alternate inter-spline spaces. The ends 36 of each electric contact strip are electrically connected to and are secured under the heads of a metallic tubular rivet-like member 38 which extends axially through the connector part 30, there being one rivet member 38 for each contact strip 34. An annular groove 40 extends about the connector part 30 preferably approximately midway along the splines 32 so that each spline 32 consists of two portions axially separated by the groove 40. As illustrated the bottom of the groove 40 is deeper than the splines 32 and an annular ring 42 of rubber-like insulating material is disposed in said groove under the contact strips 34. This is best seen in Fig. 3. The rubber ring 42 is of such size and shape as to function as a spring elastically urging the mid portion of each contact strip 34 radially outwardly.

The connector member 30 also has a shaft-like extension 44 having a plurality of axially-spaced slip rings 46 disposed for engagement with electric contact brushes 48. There is one slip ring 46 for each tubular rivet-like member 38 and electric wires 50 connect these slip rings 46 to their respective rivet members 38. As illustrated, one end of each wire 50 plugs into the associated rivet-like member 38 for electric contact therewith. If desired the wires 50 may be soldered to their rivet-like members 38. With the construction each slip ring 46 is electrically connected to a contact strip 34.

When the connector parts 12 and 30 are disposed with their splines 14 and 32 in meshing engagement, as in Fig. 1, the contact strips 34 are disposed in electric contact with their adjacent contact strips 16. The rubber ring 42 functions as a spring to urge the contact strips 34 into contact with the contact strips 16. Thus the rubber spring 42 provides initial contact pressure between the contact strips 34 and 16 which contact pressure is augmented by centrifugal force on each contact strip 34 as a result of rotation of the shaft 10.

With the construction shown only alternate spaces between the splines 32 have contact strips 34. Hence when the connector parts 12 and 30 are assembled, as in Fig. 1, the slip rings 46 are electrically connected to alternate wires 22. The elastic rubber ring 42 urges the contacts 34 into good electric contact with the contacts 16. Hence when the electric connector parts 12 and 30 are so assembled the electric signals transmitted by said alternate wires 22 can be measured by suitable measuring circuits connected to the contact brushes 48. The signals transmitted by the remaining wires 22 can be measured by disconnecting (demeshing) the electric contact parts 12 and 30 and re-meshing these connector parts after the part 30 has been rotated relative to the part 12 to engage the other contact strips 16.

The number of contact strips 34 is limited by the number of slip rings 46 which is practical. Obviously if it is possible to provide one slip ring for each wire 22 then contact strips 34 would be provided in each space between the splines 32 whereupon all the signals transmitted by the wires 22 could be measured simultaneously.

In this last situation suitable indexing means, for example a blind spline, preferably would be provided so that the electric connector parts 12 and 30 could be disposed in meshing engagement in only one relative position whereby each contact brush 48 would always be connected to a known wire 22. Where as illustrated, the number of contact strips 34 is only half the number of contact strips 16 the indexing means preferably limits the engagement of the parts to one of two positions such that in one position the brushes 48 are connected to one half of the wires 22 while in the other position said brushes are connecting to the other wires 22. Obviously the number of contact strips 34 could be any simple fraction of the number of contact strips 16.

Because the meshing splines 14 and 32 can be made of a material, such as an epoxy resin, capable of transmitting substantial torque, the invention is particularly advantageous when the shaft 10 is required to drive another member. Thus the shaft extension 44 could be used for driving a tachometer, pump or other device schematically indicated at 52.

While I have described my invention in detail in its present preferred embodiment, it will be obvious to those skilled in the art, after understanding my invention, that various changes and modifications may be made therein without departing from the spirit or scope thereof. I aim in the appended claims to cover all such modifications.

I claim as my invention:

1. In combination with a rotatable part; a first electric connector member connected to said part for rotation therewith; a second electric connector member; each of said electric connector members having axially-extending splines of insulating material for detachable meshing engagement with corresponding splines of the other member, said meshing splines providing for rotation of said second member by said first member; one of said electric connector members having electric contacts at the tip portion of at least certain of its splines and the other of said electric connector members having electric contacts at the root portion between at least certain of its splines for engagement with said first-mentioned electric contacts, said member being readily engageable and disengageable to make and break said contact engagement by axially moving said members relative to each other into and out of meshing engagement; a shaft-like extension secured to said second member; electric contact slip rings on said shaft-like extension; and means electrically connecting said slip rings to the electric contacts at the splines of said second member.

2. The combination recited in claim 1 in which the electric connector member with the contact strips between its splines has a groove across its said splines intermediate the axially-spaced ends of said splines; and said combination including an annular band of insulating rubber-like material disposed in said groove under the contact strips of its electric connector member for urging said contact strips into engagement with the contact strips of the other member when said members are disposed in meshing engagement.

3. A quickly separable electric connector comprising a first member having axially-extending external splines of electric insulating material; an annular second member having axially-extending internal splines of electric insulating material for detachable meshing engagement with the splines of said first member to prevent relative rotation of said members, each of said members having a plurality of contact strips secured thereto for engagement with the contact strips of the other member when said members are in meshing engagement, the contact strips of one of said members extending axially along the tip ends of at least certain of its splines and the contact strips of the other of said members extending axially between at least certain of its splines, said members being readily engageable and disengageable to make and break said contact strip engagement by axially moving said members relative to each other into and out of meshing engagement.

4. A quickly separable electric connector comprising a first member having axially-extending external splines of electric insulating material; an annular second member having axially-extending internal splines of electric insulating material for detachable meshing engagement with the splines of said first member to prevent relative rotation of said members, each of said members having a plurality of contact strips secured thereto for engagement with the contact strips of the other member when said members are in meshing engagement, the contact strips of one of said members extending axially along the tip ends of at least certain of its splines and the contact strips of the other of said members extending axially between at least certain of its splines, said last mentioned member having an annular groove across its said splines intermediate the axially-spaced ends of said splines; and spring means disposed in said annular groove under the contact strips of its member for urging said contact strips into engagement with the contact strips of the other member when said members are disposed in meshing engagement, said members being readily engageable and disengageable to make and break said contact strip engagement by axially moving said members relative to each other into and out of meshing engagement.

5. An electric connector as recited in claim 4 in which said spring means is an annular band of insulating rubber-like material.

6. An electric connector as recited in claim 5 in which the electric contact strips of said first member extend between its external splines and said groove extends across the external splines of said first member.

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