

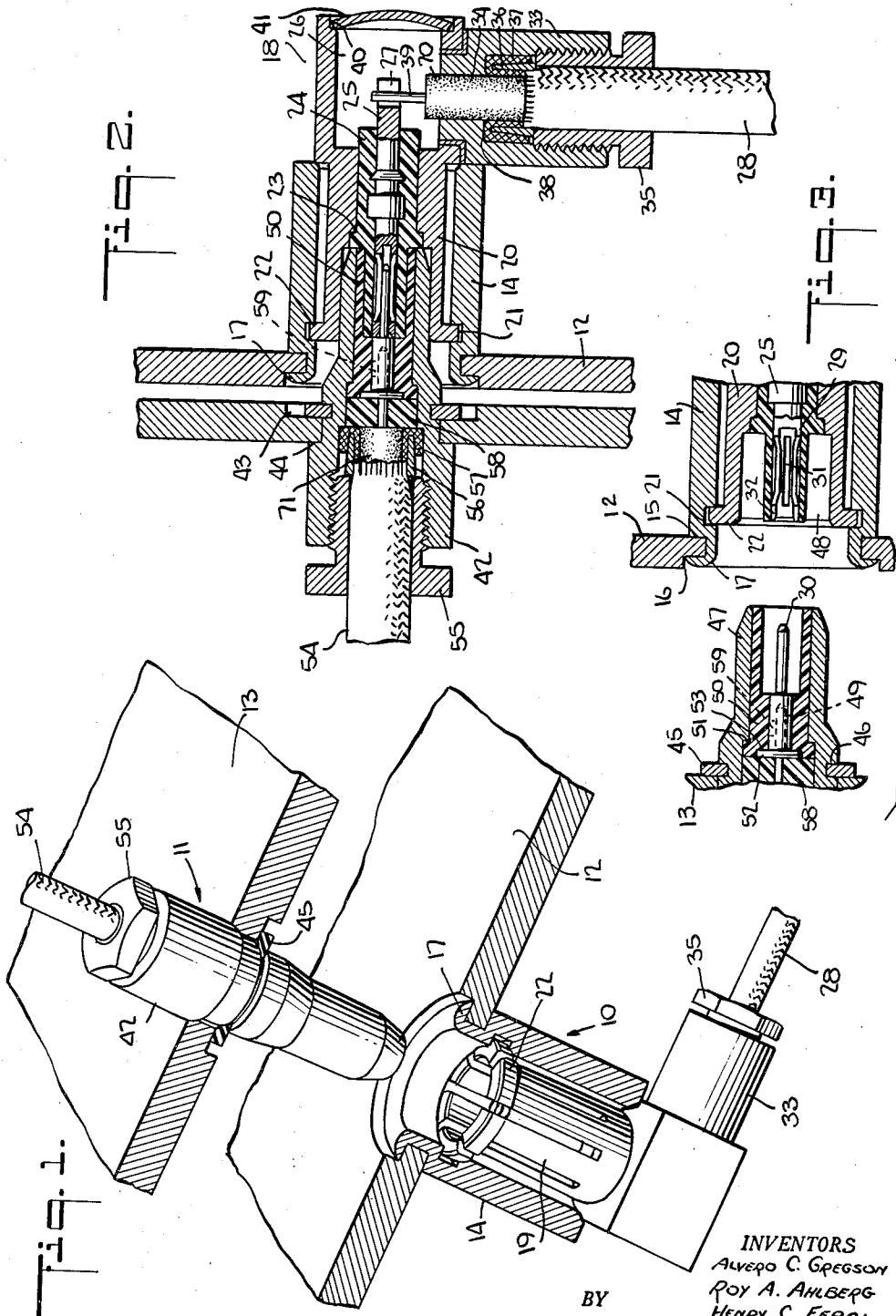
July 31, 1962

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3,047,828

CONNECTOR

Filed June 16, 1960



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1

3,047,828

CONNECTOR

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Filed June 16, 1960, Ser. No. 36,572

5 Claims. (Cl. 339-64)

This invention relates generally to connectors and more specifically to an RF connector adapted to be mounted in plug-in sub-unit chassis.

In present day electronic systems it is common practice to package sub-unit assemblies in individual chassis. These sub-unit chassis are generally provided with plug-in connectors in order to make electrical connection with the other sub-unit chassis of the system. With prior art connectors available for this purpose, it is necessary to assemble each sub-unit chassis with its cable connections, and special tools are required for the removal of each connector receptacle from the mounting cup provided on each chassis. In addition, due to tolerance accumulation it is often necessary to provide each connector with only short contact engagement which results in malfunctioning of the equipment due to vibration, movement, etc.

Another disadvantage of prior art connectors is that where a plurality of connections is necessary on a particular chassis, the spacing between each connector must be held within close tolerances. This often results in contact deformation during prolonged use.

In view of the foregoing, it is the primary object of the present invention to provide an RF connector adapted for chassis mounting which is relatively inexpensive to manufacture and which insures reliable electrical operation over a wide range of chassis and sub-unit tolerances.

A further object of the present invention is to provide an RF connector with longer contact engagement and with a floating mount.

Another object of the present invention is to provide an RF connector in which the receptacle mounting cup is spun into the chassis during fabrication, thereby permitting the cable assembly to be made up separately and thereafter installed in the sub-unit chassis by simply pushing the receptacle into the mounting cup.

These and further objectives, features and advantages of the connector of the present invention will appear from the following detailed description of the invention to be read in conjunction with the accompanying drawings wherein like components in the several views are identified by the same reference numeral.

In the drawings:

FIGURE 1 is a perspective view of the connector of the present invention, the receptacle and plug being shown mounted in different sub-units, a portion of the view being in cross-section to illustrate structural details.

FIGURE 2 illustrates the two sub-units of FIGURE 1 in electrical contact, the view being partially in cross-section in order to illustrate structural details and,

FIGURE 3 is a detailed assembly drawing in cross-section of the receptacle and plug of the present invention.

Referring now to the figures, the connector of the present invention includes the female receptacle designated in general by the numeral 10 and a male mating plug designated in general by the numeral 11. The receptacle 10 and plug 11 are both adapted to be mounted in separate chassis which are to be electrically interconnected. As illustrated in FIGURE 1, the receptacle 10 is shown mounted in a deck 12, and the plug 11 is shown mounted in a deck 13.

The receptacle 10 includes a mounting cup 14 which is adapted to be rigidly mounted on the deck 12 of a main chassis. The cup 14 is an elongated tubular member provided on the outer surface of one end thereof with an

2

annular recess 15 adapted to receive the deck 12. The deck 12 is provided with an opening 16 having a diameter slightly greater than the diameter of the recess 15. The end of the cup 14 having the recess 15 is inserted in the opening 16 in the deck 12 and the end 17 of the cup 14 is then spun over against the inner surface of the deck 12 to lock the cup 14 thereto.

The cup 14 is hollow throughout its length and is adapted to receive therein the receptacle body designated in general by the numeral 18. The sleeve portion 20 of the receptacle body 18 is adapted for insertion within the cup 14 and is provided with a plurality of axially extending fingers 19 as illustrated in FIGURE 1. The sleeve 20 of the receptacle body 18 is provided with a plurality of spaced elongated fingers 19 in order to render the sleeve portion 20 flexible for a purpose to be presently described.

The cup 14 has formed on the inner surface thereof an annular recess 21, the recess 21 being positioned near the outer surface of the deck 12. The recess 21 is adapted to receive the annular collar 22 formed on the ends of the fingers 19 when the sleeve 20 is inserted in the cup 14. When the sleeve 20 is inserted in the cup 14, the collar 22 snaps into position in the recess 21 and prevents the sleeve 20 from becoming disengaged from the cup 14. It is to be noted however that when the collar 22 is engaged in the recess 21 as illustrated in FIGURE 3, the collar 22 does not extend the full depth of the recess 21 for a purpose to be presently described.

The inner surface of the sleeve 20 spaced from the fingers 19 is provided with a shoulder 23 to provide a retaining surface for the female insulator 24 which is positioned axially within the sleeve 20. The female insulator 24 is force-fitted within the sleeve 20 or retained in position in any other conventional manner. The elongated female contact designated in general by the numeral 25 is inserted within or formed integrally with the female insulator 24. The female contact 25 is preferably molded into the female insulator 24.

As illustrated in FIGURE 2, the female contact 25 is an elongated member, one end of which protrudes beyond the end of the female insulator 24 and into a hollow space 26 provided in the end of the sleeve 20. The end 27 of the female contact 25 extending within the hollow 26 is adapted to have the lead 39 of a cable 28 attached thereto in a manner to be presently described.

The other end of the female contact 25 which is designated in general by the numeral 29 is the receptacle for the pin 30 of the male plug 11. As illustrated in FIGURES 2 and 3, the receptacle contact 29 is completely embedded in the female insulator 24, the end of the female insulator 24 being recessed with respect to the collar 22 for a purpose to be presently described.

The receptacle contact 29 as illustrated in FIGURE 3 is provided with a plurality of axially extending slots 31. The slots 31 do not extend the entire length of the receptacle contact 29, and the end of the receptacle contact 29 is a solid annular member 32 as illustrated in FIGURE 3. The receptacle contact 29 between the slots 31 is crimped as illustrated in FIGURE 3 in order to insure good electrical contact with the pin 30 of the male plug 11.

The receptacle body 18 is formed integrally with or has attached thereto, a cable extension or sleeve 33 which is positioned at right angles with respect to the sleeve 20. It is to be understood however that the cable extension 33 may be axially aligned with the sleeve portion 20. The cable sleeve 33 has a bore 34 therein to receive the cable 28.

One of the advantages of the connector of the present invention is that cable assembly is greatly facilitated since the cables may be assembled to the receptacle 10 before installation of the receptacle. By predetermining cable lengths, all cable assemblies can be fabricated prior to

3

assembly. In assembling the receptacle 10 of the connector of the present invention the cup 14 is secured to the deck 12. A gland nut 35 and a braid clamp 36 are then slipped over the end of the cable 28. A portion of the outer insulation (not shown) the metallic braid 37 and the inner insulation 70 is removed to expose a portion of the inner conductor or lead 39. The outer insulation (not shown) on the cable 28 is then further removed so that the metallic braid 37 can be turned back over the braid clamp 36. It is to be noted that the outer insulation should not be removed much beyond the end of the braid clamp 36 adjacent the gland nut 35 since this would result in possible electrical shorts. The cable 28 is then inserted in the cable sleeve 33 until the metallic braid 37 abuts against the shoulder 38 provided within the cable sleeve 33. The lead 39 of the cable 28 is then connected to the end 27 of the female contact 25. It is to be noted that the end of the sleeve 20 is provided with an opening 40 to permit interconnection between the lead 39 and the female contact 25. After this contact is made, the opening 40 is closed by a cap 41. The cable 28 is then held in position by tightening the nut 35.

When the assembly of the female receptacle 10 has been completed, the sleeve 20 is inserted in the cup 14 and to facilitate this entrance, the end of the cup and the annular collar 22 on the ends of the fingers 19 are provided with beveled edges. When the sleeve 20 is completely inserted in the cup 14 the collar 22 snaps into the recess 21 thereby retaining the receptacle body 18 in position with regard to the cup 14. It is desired to remove the receptacle body 18 from the cup 14 a slight twisting and pulling motion is exerted on the body 18 which compresses the fingers 19 and makes extraction simple and complete. It is to be noted that this snap-in type of engagement eliminates engagement problems and permits complete assemblies to be snapped into and out of engagement without tools.

The male plug 11 includes an elongated tubular body 42 which is adapted to be rigidly secured to the deck 13. The body 42 is adapted to be inserted in an opening 43 provided in the deck 13 until the shoulder 44 on the body 42 abuts against the outer surface of the deck 13. A bowed retaining ring 45 retains the body in position and is received in a recess 46 provided on the outer surface of the body 42.

The right-hand end of the body 42 as viewed in FIGURES 2 and 3 is in the form of a cylinder 47 which is adapted to be received in telescoping relationship within the cavity 48 provided in the receptacle body 18 of the receptacle 10. The cavity 48 is provided between the inner circumference of the sleeve 20 and the outer circumference of the female insulator 24. The cavity 48 and cylinder 47 are so sized and shaped that when the cylinder 47 is inserted within the cavity 48 the fingers 19 on the sleeve 20 are biased outwardly thereby further pressing the annular collar 22 on the fingers 19 within the recess 21 provided on the inner surface of the cup 14. Thus, when the mating of the plug 11 and receptacle 10 is complete the plug 11 forces the spring fingers 19 of the receptacle still further into the internal recess 21 of the cup 14, which thereby renders the receptacle immune to inadvertent disconnection. The end of the cylinder 47 and the fingers 19 are beveled in order to prevent any deformation during use. It is to be noted that with this type of connector a floating action is maintained which compensates for unavoidable tolerances in mounting hole locations.

The male contact 30, which is partially hollow to receive the cable lead 49, is molded into a dielectric insulating material 50. The insulator 50 conforms to the inner configuration of the cylinder 47 and is force-fitted therein and is retained in position by engagement with the shoulder 51 provided on the inner circumference of the plug body 42. If it is not desired to mold the insulator 50 about the male contact 30, the latter may be retained

4

in position within the insulator 50 by providing the male contact with a flange 52 which bears against a shoulder 53 provided on the end of the insulator 50.

As with the receptacle 10, cable assembly is facilitated with the plug 11 since the cable may be assembled to the plug 11 before installation of the plug 11 in the deck 13. The interconnection between the cable 54 and the plug 11 is accomplished as follows. A gland nut 55 and braid clamp 56 are first slipped over the end of the cable 54. A portion of the outer insulation (not shown) on the cable 54 is removed to a point adjacent the outer face of the braid clamp 56. The metallic braid 57 is then turned back over the braid clamp 56. The inner insulation 71 is then removed to a point adjacent the portion of the metallic braid 57 wrapped around the braid clamp 56. This exposes the cable lead 49. An insulator spacer 58 is then slipped over the cable lead 49 and into abutment with the braid clamp 56. The cable lead 49 is then inserted within the male pin 30 and is soldered or otherwise fastened in position. This is accomplished by providing a solder hole 59 in the male contact 30 through which solder may be inserted to rigidly secure the cable lead 49 to the male contact 30. When this has been done, the gland nut 55 is tightened which secures the entire assembly together.

The connector of the present invention is particularly adapted for use with sub-unit chassis which must be electrically interconnected at a number of different points. This is accomplished by mounting a plurality of plugs 11 at specified locations on the deck 13 of one sub-unit, and a like plurality of receptacles 10 at specified locations on the deck 12 of a main chassis. The sub-units may then be electrically connected by simply mating the plug bodies 42 of each plug 11 with a receptacle 10. It is to be noted that the receptacle body 18 may be easily disconnected from the cup 14 provided the receptacle 10 is not engaged with the plug 11 and that this disconnection of the receptacle body 18 from the cup 14 is virtually impossible when the plug and receptacle are interconnected. The extra electrical contact length between the male contact pin 30 and the female contact 25 insures reliable electrical connection under all conditions without appreciably increasing over-all height and this increased length provides a wiping action which minimizes corrosion.

The connector of the present invention provides superior electrical continuity between the interconnected cables. For example, actual measurements have indicated that the VSWR (volts standing wave ratio) measured at 1000 mc. is less than 1.2 and approximately 1.05 measured at 300 mc.

What has been described is an RF plug-in connector which requires less space than conventional connectors, may be installed and removed entirely by hand, permits complete bench cable assembly and is reliable in operation due to longer contact engagement, the provision of a float mounting and guided entry of the electrical contacts. It is to be understood that what has been described is one embodiment of the invention and that changes and modifications may be made thereto without departing from the scope of the invention.

What is claimed is:

1. A connector comprising first and second base plates mechanically joinable in substantially fixed relationship to each other; a first connector member fixedly attached to said first plate and extending therefrom and comprising first and second conductors in fixed, spaced relationship to each other; a second connector member comprising an outer portion rigidly attached at one end thereof to said second plate and an elongated inner portion recessed within said outer portion and extending beyond the other end of said outer portion, said inner portion having an outwardly extending flange fitting into a channel within said outer portion to be held thereby, said inner portion being longitudinally divided along a substantial portion of its length to said other end of the outer

5

portion and having outer dimensions smaller than the inner dimensions of said outer portion to permit a limited lateral movement of said inner portion within the outer portion, the outermost end of said first connector member fitting into the recess of said second connector member to spread said longitudinally divided inner portion along at least a substantial portion of its length and causing said flange to fit farther into said channel, said inner portion comprising third and fourth conductors fixedly spaced apart with respect to each other and positioned to connect with the first and second conductors of said first connector member, respectively.

2. A connector comprising first and second base plates mechanically joinable in substantially fixed relationship to each other; a first connector member substantially rigidly attached to said first plate and extending therefrom and comprising a cylindrical outer conductor and an elongated inner conductor coaxially spaced therefrom in fixed relationship; a second connector member comprising a hollow outer member rigidly attached at one end thereof to said second plate and having an interior channel, a second cylindrical outer conductor located within said outer member and having an elongated and longitudinally divided end portion and an external flange on said end portion fitting into said channel in said outer member to be held thereby against longitudinal displacement, the outer dimensions of said second cylindrical conductor being smaller than the inner dimensions of the juxtaposed sections of said outer member to permit a limited lateral movement of said second cylindrical conductor within said outer portion, the outermost end of said first-named cylindrical conductor member fitting into the longitudinally divided end portion of said second cylindrical conductor to spread said longitudinally divided end portion apart and to force said flange to fit farther into said channel, and an elongated second inner conductor coaxial with said second cylindrical outer conductor and rigidly held therewithin, said second inner conductor making electrical contact with said first-named inner conductor along substantial portions of their respective lengths when said first-named cylindrical conductor is inserted into the end of said second cylindrical conductor.

3. A connector comprising first and second base plates mechanically joinable in substantially fixed relationship to each other; a first connector member substantially rigidly attached to said first plate and extending therefrom and comprising a cylindrical outer conductor and an elongated inner conductor coaxially spaced therefrom in fixed relationship; a second connector member comprising a hollow outer member extending through said second plate and rigidly attached thereto in substantially flush-fitting relationship near one end of said outer member, said outer member having a circumferential channel around its inner wall near said one end thereof, an elongated second outer cylindrical conductor located within said outer member and having an outwardly extending

6

circumferential flange at one end thereof fitting into said channel in said outer portion to be held thereby against longitudinal displacement, said second cylindrical conductor having a plurality of elongated longitudinal slots therein extending to said one end to impart lateral resiliency to said second cylindrical conductor along a substantial portion of its length, the outer dimensions of said second cylindrical conductor being smaller than the inner dimensions of the juxtaposed sections of said outer member to permit limited lateral movement of said second cylindrical conductor within said outer member, the outermost end of said first-named cylindrical conductor fitting into the longitudinally divided end of said second cylindrical conductor to spread said longitudinally divided end portion thereof apart and to force said flange farther into said channel, and an elongated second inner conductor coaxial with said second said cylindrical conductor and rigidly held therewithin, said second inner conductor making electrical contact with said first-named inner conductor along substantial portions of their respective lengths when said first-named cylindrical conductor is inserted into the end of said second cylindrical conductor.

4. An electrical connector as claimed in claim 3 comprising, in addition, first and second generally cylindrical insulators rigidly separating the respective inner and outer conductors of said first and second connector members, respectively, the external cylindrical surface of said first insulator being contiguous with the internal surface of said outer conductor of the first connector member, said first insulator having a recessed portion forming an annular space about the forward end of said inner conductor of the first connector member, and said second insulator having, at the forward end thereof, an external diameter substantially equal to the internal diameter of the recessed portion of said first insulator and an internal cylindrical surface contiguous with the external surface of said inner conductor of the second connector member whereby the forward ends of said first and second insulators cooperate to form a substantially solid and substantially continuous insulator filling the space between the forward ends of said inner conductors and said outer conductors.

5. An electrical connector according to claim 1, including retainer ring means for fixedly attaching said first connector member to said first plate and whereby said first connector member has a limited range of floatable movement with respect to said first plate.

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