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T. W. HECKING
COAXIAL SOCKET CONTACT
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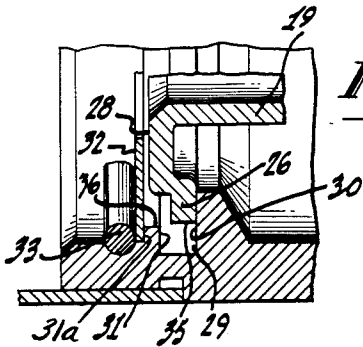
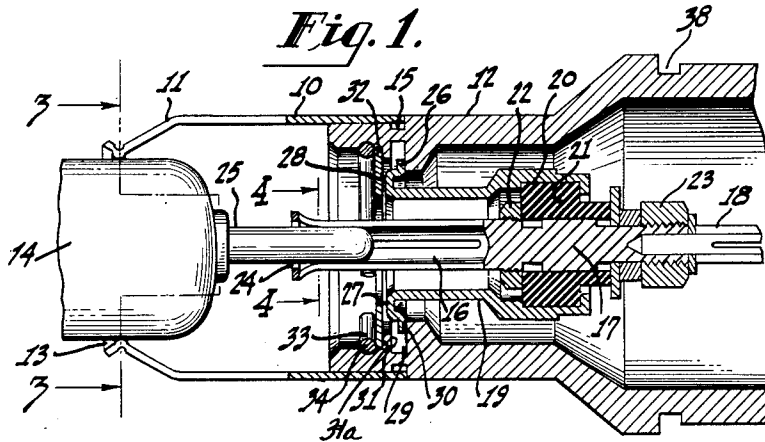
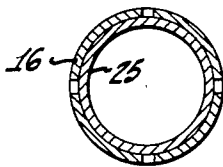
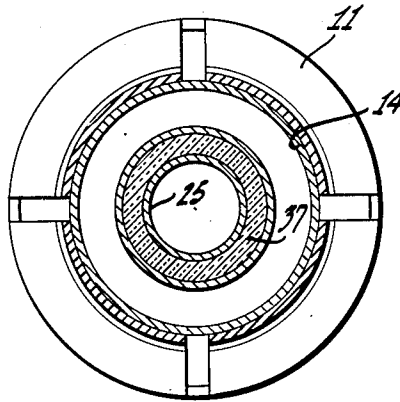


Fig. 3.



Inventor
THEODORE W. HECKING
By *William A. Zalesak*
Attorney

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COAXIAL SOCKET CONTACT

Theodore W. Hecking, Audubon, N. J., assignor
to Radio Corporation of America, a corporation
of Delaware

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The present invention relates to sockets for electrical connectors and more particularly to coaxial socket devices for connection to coaxial elements of an electron tube or other electrical apparatus.

In ultra-high frequency applications it is sometimes desirable to removably connect a coaxial transmission line to electrical apparatus such as, for example, an electron tube. To permit of such connection, the apparatus is usually provided with external coaxial conducting members or prongs insulated from each other. Usually such conducting members cannot be directly connected to the coaxial line with which it is desired to associate them. Use is, therefore, made of an adapter device intermediate the coaxial conducting members and the coaxial line, having socket contacts for removably receiving the conducting members.

Some uses of electrical apparatus require frequent connection to and disconnection from a coaxial line. In these applications it is desirable that the operations referred to be performed easily and rapidly.

It is, therefore, a principal object of the invention to provide socket contacts for electrical connection of coaxial elements which are characterized by facility in use and a rapidly accomplished registration of the elements.

The coaxial conducting elements of some apparatus requiring connection to a coaxial transmission line are offset axially in such a manner that the inner member of such elements extends inwardly axially of the outer member. To accommodate such elements, the socket contacts of the adapter are also required to be axially displaced, the inner socket being disposed within the outer socket at a depth commensurate with the axial displacement of the elements referred to. Several difficulties are encountered in accomplishing a proper engagement between the inner of the elements referred to and the inner socket of the adapter. For example, the coaxial conducting members of an electrical apparatus may not always be exactly concentric with the result that a centering of the outer member with respect to the adapter may not result in a registry between the inner member and the inner socket of the adapter. Furthermore, it is relatively difficult to dispose the adapter in coaxial relation to one of the conducting members to be received thereby until the members actually enter their respective sockets. As a result, engagement between the inner member and the inner socket which are hidden from view when the connection is being made, is sometimes forced with consequent damage to the parts involved.

It is, therefore, a further object of the invention to provide a socket contact having coaxial sockets for connection to coaxial elements of an

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electrical device which accommodate themselves to inaccuracies in structural features of the device and to improper handling during the connecting operation.

Another object is to provide a socket device having coaxial sockets wherein one of the sockets properly adjusts itself with respect to one of two coaxial conducting members received thereby.

An additional object is to provide a socket device having coaxial sockets which adjust themselves to coaxial members on the application of force to said members axially thereof.

It is a further object to provide an adjustable connector having coaxial sockets wherein means are provided for preventing injury to the sockets on forceably connecting associated conducting members thereto in the absence of proper registry between said members and sockets.

Another object is to provide an adjustable socket for coaxial conducting members in which means are utilized for directing the force employed in inserting members in said socket in such a manner that the force is used substantially for obtaining a proper registry between said members and said socket and for effecting an entrance of said members into said socket.

A still further object is to provide a connector device having coaxial sockets which can readily be disassembled for replacement of parts.

Further objects will appear as the present description proceeds.

In the drawing, to which reference is now made for a specific embodiment of my invention:

Figure 1 is a longitudinal section of the novel socket contact of the invention, with coaxial prongs of an electron tube in operative position therein;

Figure 2 is an enlarged view of a portion of Figure 1, showing the mounted relationship between the inner and outer sockets of my invention;

Figure 3 is a sectioned view along the line 3—3 of Figure 1 and shows the spring contact between the outer socket of my invention and the outer coaxial prongs of an electron tube; and

Figure 4 is a view in section along 4—4 of Figure 1, and indicates the engagement between spring member of the inner socket and the inner coaxial prong of the tube.

Referring now to Figure 1 in more detail, there is shown an electrical connector employing the novel socket contacts of my invention in operative association with coaxial conductors, such as two lead-ins of an electron tube. The electrical connector shown includes an outer socket assembly and an inner socket assembly.

The outer socket assembly comprises a tubular end portion 10 having flexible fingers 11, and a tubular support 12. The tubular portion 10 is provided with a flared end 13 for facilitating re-

ception of the outer conductor 14 of a coaxial conductor array. The end of tubular portion 10 remote from the flared end 13 may be rolled into and/or soldered to peripheral slot 15 provided in support 12, to accomplish a fixed mounting and support of tubular end portion 10 on support 12.

The inner socket assembly includes a tubular member 16, the walls of which are formed by flexible fingers. Tubular member 16 is integral with a solid body 17, which is provided with an additional tubular portion 18 for receiving a conductor, not shown, of a coaxial transmission line. The inner socket assembly also includes a tubular support 19 having an internal recess 20 at one end thereof for receiving in a snug fit a semi-resilient insulating bushing 21. Bushing 21 is provided with a tubular passageway for receiving the solid body 17, which is provided with additional threads on body 17 for securely supporting said body in bushing 21. The end 24 of tubular member 16 is flared to contribute to ease of insertion therein of inner conductor 25 of the coaxial conductor array referred to.

A further feature of the invention relates to a novel mounting of the inner socket assembly within the outer assembly. Tubular support 19 of the inner socket assembly is provided with a flange 26 at the end thereof remote from the internal recess 20. Intermediate the flange 26 and the walls of support 19 is a flared end portion 27 having a bearing surface 28. The inner wall of tubular support 12 of the outer socket assembly is provided with a groove 29, which is formed by shoulders 30, 31.

Shoulder 30 extends inwardly of tubular support 12 to provide a bearing surface for one face of flange 26. Groove 29 is of greater transverse extent than flange 26 so that a path is provided for transverse movement of flange 26 in the groove. Shoulder 31 extends inwardly of tubular support 12 to a less degree than shoulder 30. Thus, as more clearly shown in Figure 2, the edge 35 of flange 26 is of less transverse extent than the edge 36 of shoulder 31. If the restraint of washer 32 is removed, the clearance between edges 35 and 36 permit longitudinal movement of the inner socket assembly for removal thereof from the outer socket assembly if this should be desired for inspection and repair. Instead of removing the entire inner assembly it is possible to remove only the tubular member 16 thereof to repair, for example, broken fingers of this member. Removal of member 16 from the outer assembly while permitting the tubular member 19 to remain in association with the outer assembly, may be accomplished by removal of nut 23 which permits member 16, 17 to be disengaged from bushing 21.

In operation flange 26 is held against the bearing surface of shoulder 30 by a metallic washer 32, which engages shoulder 31a. Washer 32 is held in position by a split ring 33 which engages an additional groove 34 on the inner wall of tubular support 12. Ring 33 is under suitable compression to urge it into position in groove 34. However, it may be manually compressed and removed to permit removal of washer 32 and the inner socket assembly. The bearing surface 28 on the tubular support 19 may engage a surface of washer 32 to hold the inner socket assembly against longitudinal movement in a direction opposite to the bearing surface on shoulder 30. The combination of the bearing surface on shoulder 30 and the surface referred to of washer 32 cooperate therefore to constrain the inner socket

assembly against longitudinal movement in either direction. To permit free transverse travel of the flange 26 between shoulder 30 and washer 32, shoulder 31 is spaced a suitable distance from shoulder 31a so as to displace the washer 32 from the bearing surface 28 by a value sufficient to prevent a binding of flange 26 therebetween.

Figure 2 shows on a larger scale a portion of the device depicted in Figure 1. This portion concerns the relation of flange 26 to the bearing surface on shoulder 30 and to shoulder 31, and the relation of the bearing surface 28 on tubular support 19 to washer 32. This view shows more clearly the clearance between edge 35 of flange 26 and the edge 36 of shoulder 31, when the inner socket assembly is centered in the outer socket assembly. It also shows a space between bearing surface 28 and washer 32 to permit free transverse movement of flange 26 on the bearing surface of shoulder 30.

The clearance between washer 32 and bearing surface 28 is less than that between flange 26 and the bearing surface on shoulder 30, so that at no time is there danger of edge 35 striking the corner of shoulder 31.

Figure 3 is a cross sectional view along 3—3 of Figure 1, and shows the resilient fingers 11 of the outer socket assembly, and the concentricity of the inner and outer coaxial conductors 14, 25 with insulation 37 provided between these conductors.

Figure 4 shows a cross section along 4—4 of Figure 1 and depicts the fingers 16 of the inner socket assembly engaging the inner conductor 25.

One use of the novel electrical connector of the invention may be in association with an electron tube having coaxial lead-ins 14, 25, and a concentric transmission line, not shown, in applications involving ultra-high frequencies. Lead-ins of an electron tube adapted for such use may be coaxially arranged and offset along their longitudinal axes. The connector of my invention is particularly suited to effect a connection between such lead-ins and a transmission line. To this end the socket members formed by fingers 11 and tubular member 16 are longitudinally offset to accommodate the offset lead-ins 14, 25. At the end of the connector remote from the socket members referred to there is provided a groove 38 in support 12 for retaining in position the outer conductor of a transmission line, and a socket member 18 for receiving the inner conductor of such line.

My novel connector is of particular advantage in an application of this sort. As will be noted the inner tubular socket member 16 is disposed at a substantial distance within the outer socket member 10 from the open end 13 thereof. The insertion of the inner conductor in said socket member therefore involves a blind operation. If the coaxial conductors are precisely concentric and the inner end outer sockets 10, 16 are exactly centered, no problem would arise. But it frequently happens that either the concentricity of the coaxial conductors 14, 25 or that of the members 10, 16, or both, is disturbed in handling, with the result that the inner conductor 25 may not always properly engage the socket member 16 on initiating an insertion operation. The resort to force in this connection may result in damage to either the conductor or the socket, or both.

Where the inner socket is fixed against transverse movement with respect to the outer socket, the damage resulting from a forced insertion of a conductor can easily be appreciated. For

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example, it is very likely that the force employed in overcoming opposition to the insertion of conductor 25 into socket 10, may not correct the faults in concentricity which result in the opposition, but may aggravate such faults, and if sufficient force is used, may in fact break the socket or the conductor or the electronic tube beyond repair.

While the provision of a structure permitting free transverse movement of the inner socket assembly within the outer assembly contributes to a proper insertion of coaxial conductors in the sockets by permitting the inner assembly to align itself with the inner conductor, a further advantage is contributed by supporting the inner assembly at a critical location along its longitudinal axis. For example, if the tubular support 19 of the inner socket assembly were supported within the outer tubular support 12 at a location adjacent its end remote from flange 26, the force employed in inserting conductor 25 in socket 16 would result in two components, particularly if the opposition is encountered at the opening 24 of the socket. One of these components would have a direction axially of unit 16 and the other component would be transverse to this axis. But due to the longitudinal displacement of the point of support from the location of the application of the force, the longitudinal component would be larger of the two and might result in sufficient friction at the support point to prevent any transverse motion of the inner socket assembly. To support the inner assembly end remote from flange 26 is therefore undesirable notwithstanding the normal freedom of the inner assembly to move transversely within the outer assembly.

According to a further feature of the invention therefore the inner socket assembly is supported within the outer socket assembly at a location on the inner socket assembly which is preferably closer to the end 24 of the socket than to the end of the tubular support 19 remote from flange 26. In accordance with this feature, flange 26 is disposed on tubular support 19 at a location which is closer to the open end 24 of the socket than to the end of the support remote from the open end 24 referred to. As a result of this structural arrangement, the application of a force to the open end 24 of the inner socket will result in a sufficiently large lateral component to transversely move the inner assembly with respect to the outer assembly. In this situation the longitudinal force component will be insufficient to produce a braking effect on the engagement between the shoulder 30 and flange 26.

An additional feature of the invention is the semi-resilient coupling between the tubular socket 16 and the support 19 which is afforded by bushing 21. This coupling contributes additional flexibility to the inner socket assembly, and further reduces the hazards of damage to the device.

While one embodiment has been selected for a description of the invention, it is obvious that many modifications may be made therein by persons skilled in the art without departing from its spirit, and I therefore desire the invention to include such modifications and to be limited only to the extent required by the appended claims.

I claim:

1. A coaxial socket device comprising two axially displaced coaxial tubular members for receiving axially displaced coaxial conductors, the outer of said tubular members including

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means on its inner surface for supporting the inner of said members, a flange on said inner of said members, said flange being spaced from each end of said inner of said members and electrically insulated therefrom, a surface of said flange engaging a surface of a portion of said means, a member spaced a predetermined distance from a surface of said flange opposite to said first-named surface thereof, and an additional member engaging a surface of an additional portion of said means and constrained against movement thereby, said additional member supporting said first-named member against movement axially of said device, whereby said inner of said members is slidably mounted for transverse movement only, said transverse movement being in a plane at right angles to the longitudinal axis of the tubular members.

2. A coaxial socket contact comprising an inner and an outer socket member coaxially arranged, said inner socket member including a tubular portion having flexible walls and an open end for receiving a conductor, a support for said tubular portion, said support insulatingly engaging the other end of said tubular portion and extending towards said open end thereof, means on said support at the extremity thereof closest to said open end of said tubular portion engaging said outer socket member for preventing relative longitudinal movement between said outer socket member and said support, said means providing a space for permitting sliding transverse movement only between said outer socket member and said support, said transverse movement being in a plane at right angles to the longitudinal axis of said inner and outer socket members, whereby said tubular portion is adjustable to receive a non-registering conductor.

3. A coaxial socket device having two axially displaced coaxial tubular members, each of said members comprising a receptacle and support therefor, the outer of said members having a plurality of inner annular shoulders, the inner of said members having a radially extending flange engaging one of said shoulders for sliding movement relative thereto, said sliding movement being restricted to a plane at right angles to the axis of said coaxial tubular members, and means to restrict non-sliding relative movement, said means including the others of said shoulders, the receptacle of said inner of said members being electrically insulated from the said support therefor.

THEODORE W. HECKING.

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