

[54] ASYMMETRICAL ELECTRICAL CONNECTOR WITH ALIGNING MEANS

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[58] Field of Search 339/47-49, 339/59, 94, 60, 89, 90, 184, 186, 185

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ABSTRACT

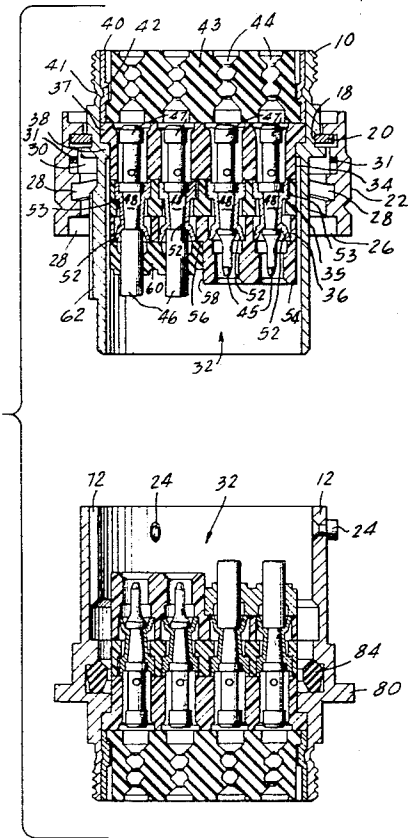
In an electrical connector the plug shell and the receptacle shell contain inserts having both pin type contact members and socket type contact members, the inserts having correspondingly stepped facing surfaces, each of the pin contact members being recessed within an extended portion of such stepped surface.

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7 Claims, 3 Drawing Figures



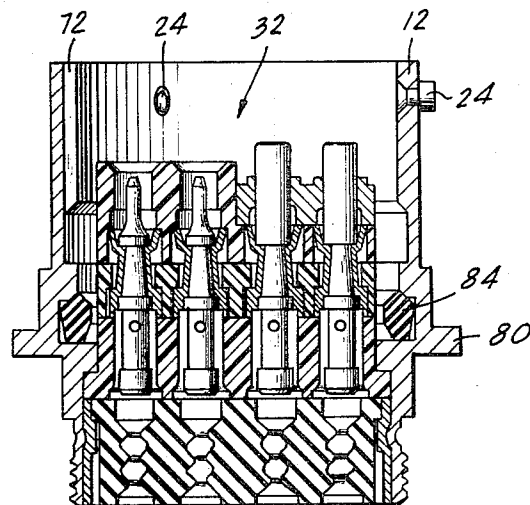
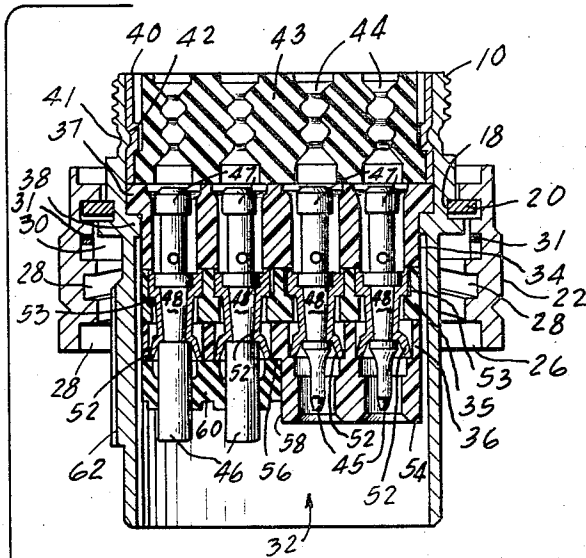


Fig. 2

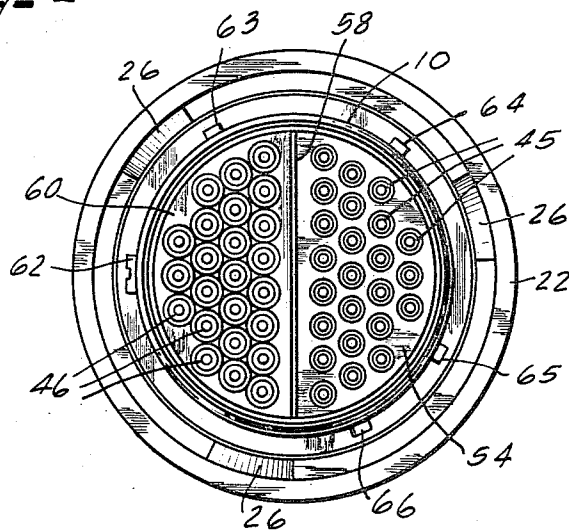
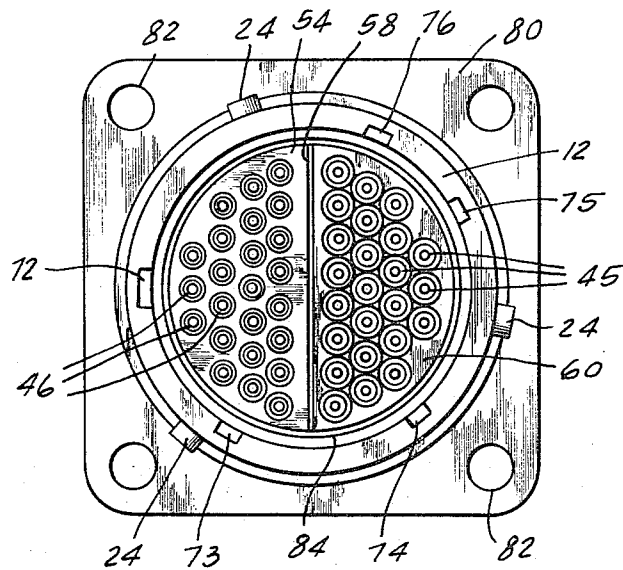


Fig. 3



ASYMMETRICAL ELECTRICAL CONNECTOR WITH ALIGNING MEANS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to electrical connectors and more particularly to connectors having means for preventing the accidental coupling of unpaired connector shells having the same size and the same contact arrangement.

2. The Prior Art

In the prior art many connector assembly structures have been devised, with a variety of schemes for preventing engagement of the two shells of the connector unless they are properly aligned. In some cases, an asymmetrical contact arrangement is provided, to prevent electrical mating when the shells are not aligned. In other cases, one or more keys are provided on one shell, and keyways are provided at corresponding positions on the other shell. While these techniques are effective, there are occasions when multiple connectors with the same contact arrangement and with the same arrangement of keys and keyways are used, and in these circumstances, it is desirable to provide further means for preventing electrical mating of unpaired connector shells. Moreover, even when cooperating keys and keyways are provided, the keys and keyways suffer wear during use, and may, after a time, fail to function in a manner which insures proper alignment of the connectors. It is therefore desirable to provide another means for insuring proper alignment of the shells of a connector prior to coupling.

SUMMARY OF THE INVENTION

In accordance with one embodiment of the present invention there is provided an electrical connector having a pair of shells containing inserts bearing contact members and means for holding the shells together in coupled relation, the inserts of both shells having correspondingly stepped facing surfaces, each of said inserts bearing both pin contact members and socket contact members, such pin contact members being recessed within the extended portion of the stepped surface, and the socket contact members extending beyond the recessed portion of the stepped surface.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference will now be made to the accompanying drawings in which:

FIG. 1 is a cross-sectional view of a connector incorporating an illustrative embodiment of the present invention, with the two shells separated, the plane of the cross-section passing through the axis of both shells;

FIG. 2 is a plan-view of the contact face of one shell of the connector; and

FIG. 3 is a plan-view of the contact face of the other shell of the connector.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1 the two shells 10 and 12 of the connector are shown in separated relationship. The plug shell 10 is adapted to be received within the receptacle shell 12. Both the shells 10 and 12 are tubular bodies of generally circular cross-section, and are generally axially symmetric. The shell 10 is provided with an annular groove 18 which receives a lock ring 20.

The lock ring 20 is also received within an annular groove on the interior of the coupling nut 22, which is supported for rotation relative to the shell 10 and maintained in position by the lock ring 20. Rotation of the coupling nut 22, after the shells 10 and 12 are brought into assembled relationship, tightens the coupling and locks the two shells 10 and 12 together. The shell 12 has a plurality of pins 24 equally spaced around the periphery thereof and protruding outwardly therefrom. The pins 24 are received in notches 26, provided on the interior of the coupling nut 22. Spiral grooves 28 lead from the notches 26 to an annular chamber 30. When the shells 10 and 12 are properly engaged, the pins 24 are received within the recesses 26 and rotation of the coupling nut causes the pins to pass along the grooves 28 until the coupling nut has been rotated sufficiently as to cause the pins 24 to enter the chamber 30. A plurality of spring members 31, one for each pin 24, engage the pins when they enter the chamber 30 and function as detents to help to prevent the coupling nut 22 from rotating in the uncoupling direction. The force produced as a result of the pins 24 bearing against the side of the grooves 28, brings the two shells 10 and 12 toward each other until their various cooperating contact members are mated, and in good electrical contact with each other.

Each of the shells 10 and 12 contain within the interior thereof an insert 32 made up of a plurality of plate-like layers 34-36 which cooperate with each other to support a plurality of contact members in fixed position. The insert 32 is formed of three layers of relatively rigid plastic material, all of them generally in the form of right circular cylinders. The outermost plate 34, meaning the furthest removed from the area between the two unconnected shells 10 and 12, has an outwardly extending flange 37 which cooperates with an inwardly extending flange 38 provided on the interior of the shell 10. The flange 38 prevents the plate 34 from moving inwardly (i.e., toward the other connector shell) in the shell 10. A retaining ring 40 prevents the plate 34 from moving outwardly relative to the shell 10. The retaining ring 40 has a groove 42 which cooperates with an annular, inwardly extending protuberance 41 provided on the inner surface of the shell 10, maintaining the retaining ring 40 in position relative to the shell 10 therefore also maintaining the plate 34 in the position illustrated. The interior of the retaining ring 40 is filled with a circular cylindrical body 43 formed of elastomeric material and having a plurality of apertures 44 through which conductors (not shown) may pass to reach the contact members of the connector. The apertures 44 are preferably equally spaced apart, and are aligned with corresponding apertures provided in the plates 34-36, in which the contact members 45 and 46 are supported.

The contact members 45 and 46 are each formed as a body of revolution, having a tubular end portion 47 for facilitating electrical connection with conductors passing through the apertures 44, and a spool-like mid portion 48. The mid portion of the contact members are surrounded by retainer members 52 having an outer end rim for engaging the inner surface of the plate 34, and an inner end rim for engaging a shoulder formed within the interior of each aperture within the plate 36. Each retainer member 52 also has a shoulder 53 formed at the inner end of an annular flange located adjacent the outer end rim, which shoulder engages a

shoulder provided within each aperture extending through the plate 35.

The assembly of the insert 32 from three plates 34-36 allows the plates 34-36 to be molded, and the required shoulders and flanges are formed where they are required, without the need for any unusual molding techniques.

The contact members 45 and 46 supported in the inserts 32 each include pin contact members 45 and socket contact members 46. The connector of the present invention is an asymmetrical connector because both pin contact members and socket contact members are supported within each shell. The pin contact members 45 of the shell 10 are aligned in coaxial alignment with the socket members 46 of the shell 12, and vice-versa. The contact members 45 and 46 are brought into engagement with each other by moving the two shells together along their common axis, whereby each of the socket members receives a corresponding pin member, and establishes firm electrical contact therewith.

The innermost plate 36 has a stepped inner surface facing the opposite connector shell, having an extended portion 54 and a recessed portion 56, separated by a step surface 58 which is generally parallel with the axis of the connector. The extended surface portion 54 extends inwardly beyond the inner ends of the pin contact members 45, while the socket contact members protrude beyond the plate 36 toward the opposite connector shell. An elastomeric body 60 overlies the recessed surface portion 56, and the socket members 46 extend through the body 60 and beyond the extended surface portion 54.

The two inserts 32 for the shells 10 and 12 are identical, and so the above description applies equally to both inserts.

When the two connector shells 10 and 12 illustrated in FIG. 1 are to be coupled together, they are aligned coaxially as shown in FIG. 1, and brought together along their common axis. If they are not angularly aligned in such a way as to permit engagement of the contacts with each other, the ends of the socket member 46 bear against the extended surface portion 51 of the insert 32, and cannot make contact with any of the pin members 45. Contact between mismatched pin contact members and socket contact members is thereby prevented. Electrical contact is made only when the socket contact members 46 can enter the apertures of the plate 36 far enough to engage the pin contact members 45, which occurs only when the alignment is proper.

FIGS. 2 and 3 illustrate the cooperative arrangement of the various socket contact members 46 and pin contact members 45 provided for each of the two connector shells shown in FIG. 1.

The three plates 34-36 which make up the insert 32 are maintained in assembled relationship by virtue of the elastomeric body 60 which bears against the recessed surface 56 of the plate 36. The friction between the elastomeric body 60 and the socket contact members 46 prevents the body 60 from moving away from the insert 32, and therefore holds the various portions of the insert 32 in place. Compression of the body 60 during coupling provides a force which maintains the coupling nut 22 in proper position.

The shells 10 and 12 may be provided with cooperating keys and keyways if desired, and as shown in FIGS. 2 and 3, keys 62-66 are provided on the shell 10, for

cooperation, respectively, with keyways 72-76 provided on the shell 12.

The shell 12 may be provided, if desired, with a flange 80 having bolt holes 82 facilitating mounting the shell in a fixed location. The shell 12 also preferably has a resilient sealing ring 84 (FIG. 1) disposed where it can be engaged by the inner rim of the shell 10, to establish a moistureproof seal between the shells.

From the foregoing description, it is seen that a connector constructed in accordance with the present invention achieves the function of preventing mating of the contact members of the connector when they are not in properly aligned relationship, irrespective of any key-keyway arrangement. The stepped facing surfaces of the inserts 32, and the extended portions thereof, maintain separation of the various contact members until the proper angular alignment is obtained, and positively prevent mating with a conventional connector of the same shell size, whether socket type or pin type.

Although the step surface 58 is centrally disposed in the embodiment described above, it will be appreciated that the location and shape of the step surface may be modified to prevent mating of unpaired connector shells of the asymmetrical type. For example, the connector may have more than half of the contact members on one shell of the pin type, with the paired shell having more socket type contact members, so that the step surface 58, as viewed in FIGS. 2 and 3, is not positioned along a diameter of the insert 32. The step 58 may form a plane parallel to the axis of the connector but spaced from the axis thereof, or may alternatively form a cylindrical curved surface enclosing a group of contact members. In either case, the paired shell has an insert with a step 58 formed to cooperate with the insert of the paired shell. In this way, a large number of uniquely paired connectors may be produced, each which will not mate with unpaired shells, irrespective of keying arrangements.

What is claimed is:

1. In an electrical connector having a pair of cooperating shells for containing contact bearing insert members and means for maintaining said shells in coupled relation with each other, a pair of insert members for said shells, each of said insert members having a stepped surface with an extended surface portion and a recessed surface portion facing the insert member of the opposite shell, a plurality of contact members of a first type being mounted in fixed relationship with said insert member in axial alignment with said extended surface portion, and a plurality of contact members of a second type being mounted in fixed relationship with said insert member in axial alignment with said recessed surface portion, said contact members of a first type comprising pin type contact members, and said contact members of a second type comprising socket type contact members, said pin type contact members each comprising a pin mounted within an aperture in said insert member and located within the extended portion of said insert, said socket members extending beyond the recessed portion of said insert, the contact members of the second type extending toward the cooperating shell a greater distance than the contact members of the first type.

2. Apparatus according to claim 1, wherein said socket type contact members are each mounted on said insert member and extend beyond said recessed surface

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portion toward the insert member of the opposite shell.

3. Apparatus according to claim 2, wherein said socket type contact members extend beyond said pin type contact members.

4. Apparatus according to claim 1, including a layer of elastomeric material adjacent said recessed surface portion for engaging the extended surface portion of the insert member of the opposite shell when said shells are in coupled relation.

5. Apparatus according to claim 4, wherein said contact members of a second type extend through said layer.

6. In an electrical connector having a pair of cooperating shells for containing contact bearing insert members and means for maintaining said shells in coupled relation with each other, a pair of insert members for said shells, each of said insert members having a stepped surface with an extended surface portion and a recessed surface portion facing the insert member of the opposite shell, a plurality of contact members of a first type being mounted in fixed relationship with said insert member in axial alignment with said extended surface portion, and a plurality of contact members of

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a second type being mounted in fixed relationship with said insert member in axial alignment with said recessed surface portion, the contact members of the second type extending toward the cooperating shell a greater distance than the contact members of the first type, said insert member comprising a plurality of superposed plate members having aligned apertures therein for mounting said contact members, each of said contact members being maintained in axial alignment by a pair of spaced apart shoulders provided on the interior surface of its aperture, one of said shoulders being located on one of said plate members, and the other of said shoulders being located on a different one of said plate members.

7. Apparatus according to claim 6, wherein the plate member which is most remote from the opposite shell is provided with a radially outwardly extending flange engaging on one side a shoulder of the shell containing said insert member, and including a lock ring in fixed engagement with said shell, said lock ring engaging the other side of said flange to support said insert member in fixed relation with said shell.

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