United States Patent

Riley et al.

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[54] GROUNDING ELECTRICAL CONNECTOR

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[52] **U.S. Cl.** .....**339/189 R**, 339/262 R

[51] **Int. Cl.** **H01r 13/50**

[58] **Field of Search**.....339/14, 82, 88, 90, 42, 184, 339/186, 193, 187, 188, 258, 259, 262, 189

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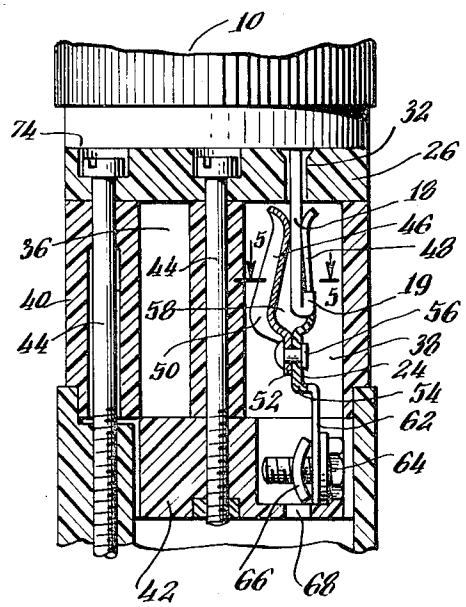
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Primary Examiner—Marvin A. Champion
Assistant Examiner—Robert A. Hafer
Attorney—Wooster, Davis & Cifelli

[57] **ABSTRACT**

The female connector device of an electrical connector is provided with a common contact spring assembly arranged for receiving and contacting male blades of different design for keying purposes. The spring assembly includes a pair of spring members interconnected at one end and separable from each other at the other end which together define a void inward from the separable end which permits free movement of key projections on the male contact. This void is created by providing at least one of the spring members with a V-shaped portion and a transition area in which it changes from its V-shape into a flat section where it is connected to the other spring member which carries the binding screw and binding plate. The transition area of the V-shaped spring member defines the void or clearance between the spring members so as to provide a space to clear the key projections of differently designed male blades.

10 Claims, 8 Drawing Figures



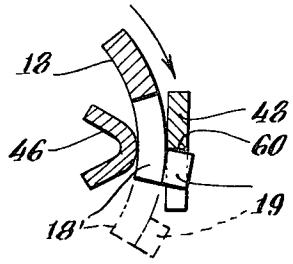


Fig. 1.

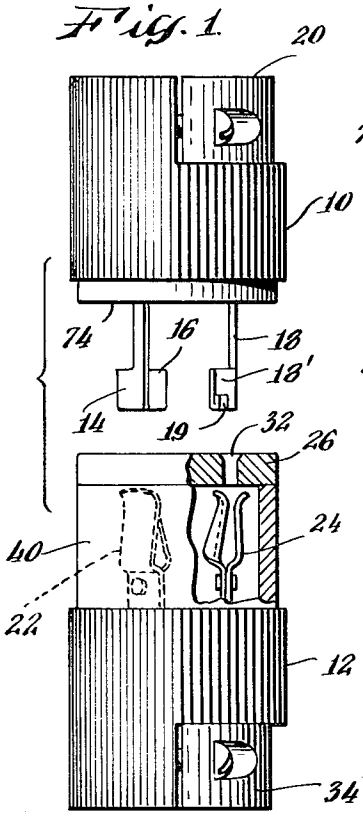


Fig. 2.

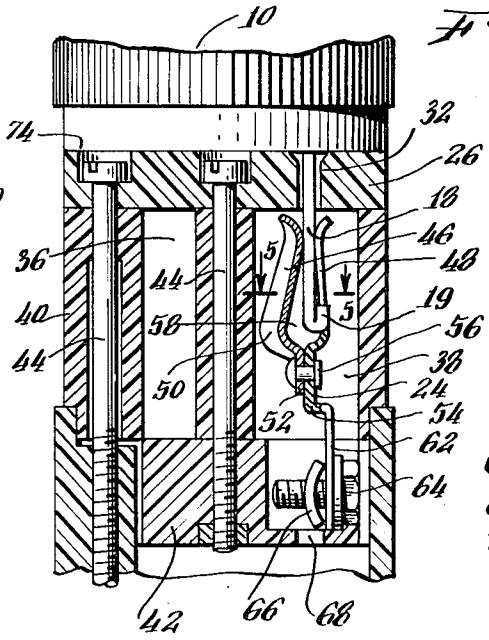


Fig. 3.

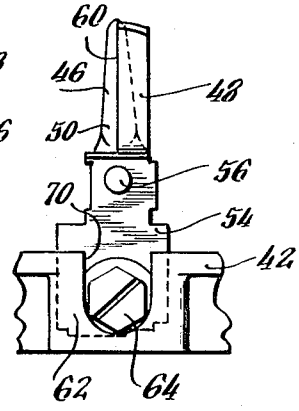


Fig. 4.

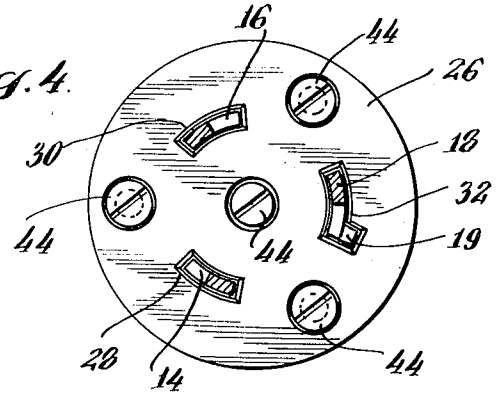


Fig. 5.

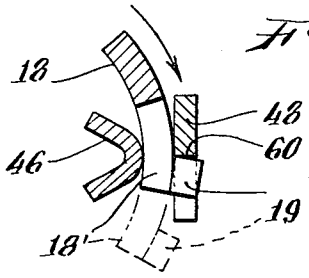


Fig. 6.

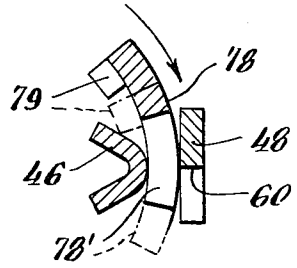


Fig. 7.

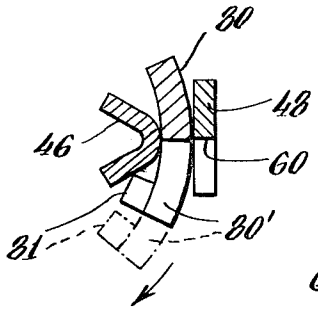
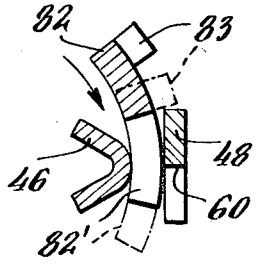


Fig. 8.



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GROUNDING ELECTRICAL CONNECTOR

BACKGROUND OF THE INVENTION

The present invention, in general, relates to locking electrical connectors and, more particularly, to an improved contact spring assembly for such connectors.

Electrical connectors of the interlocking type usually include a male connector device with a number of male electrical blades, and a female connector device with a number of female electrical contacts arranged to receive the male blades. Conventionally, the female contacts are in the form of looped or interconnected spring members. Usually the contact blades are arranged with locking means to interlock the male and female devices upon insertion of the blades into the contacts and subsequent rotation of the male device relative to the female device. Such locking means usually are in the form of laterally extending flags provided on the male blades. In addition, the female devices usually include a closure member provided with a number of slots corresponding to the number of blades on the male device to permit access of the male blades into the contacts. The flags usually are moved under portions of the closure member adjacent the slots, by relative rotation of the connector members to interlock them.

To prevent interchangeability of connectors with different electrical ratings both the blades and the slots can be configurated with a number of different patterns such as long and short arcuate slots. To provide even more combinations the blades may be provided with inwardly or outwardly radially extending key projections on either side of the blades. The device must therefore provide the necessary clearance to allow these key projections to clear the slots and enter the contacts. Moreover, since the male and female devices are interlocked by rotation of the blades relative to the contacts, the female contact must also provide clearance for movement of the key projections during such rotation. Heretofore conventional contacts, of necessity, have been configured in various patterns to accommodate the differently shaped blades. To accommodate the key projections notches were cut in the left or right side of either the inner or outer spring member depending on the location of the key projection. This reduced the spring force of the cut member as well as its current carrying capability. This also required the manufacture and storage of a large number of differently configured contacts to accommodate the differently shaped blades.

It is therefore desirable for economic reasons, to use a common contact which permits the contacting of male blades with different configurations. It is also desirable to provide such a common contact which may be used in other female devices such as receptacles, outlets and the like.

SUMMARY OF THE INVENTION

With the foregoing in mind, it is the object of the invention to provide a common contact assembly for electrical female devices which permits the contacting of male electrical contacts having different designs.

It is another object of the invention to provide a common contact assembly which can accommodate radially extending key projections without reducing its spring force or its current carrying capability.

Such an improved contact assembly according to the invention comprises a first generally planar spring member and a second generally V-shaped spring member. The first spring member may have a portion cut away to a center line thereof. The second spring member includes a transition area in which it changes from its V-shape into a flat portion connected to one end of the first spring member carrying a binding screw and a binding plate. The transition area defines a clearance between the first and second spring members to provide an area to clear the key projections of a male blade received between and contacted by the two spring members.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features and advantages of the invention will be apparent from the following description and the attached drawings, wherein:

FIG. 1 is a composite perspective view, partly in section, of an electrical connector embodying the invention;

FIG. 2 is a composite fragmentary view, partly in section, of the connector of FIG. 1, and showing the female connector device and the contact assembly of the invention incorporated therein;

FIG. 3 is a side view of the contact assembly incorporated in the connector assembly of FIG. 2;

FIG. 4 is a top view of the female connector device of FIG. 2;

FIG. 5 is a cross-sectional view taken on the line 5—5 of FIG. 2, showing the assembly in contacting condition; and

FIGS. 6, 7 and 8 are views similar to FIG. 5, but illustrating the contact assembly as male contact blades of different design.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings in which like reference numerals index like parts and with attention initially directed to FIG. 1, there is shown for illustrative purposes only, an electrical connector including a male connector device **10** and a female connector device **12**. The male device includes line blade members **14, 16**, and a grounding blade member **18** having a key projection **19**. Of course either one or both of the line blade members may be provided with key projections in addition to or instead of the keying projection **19** on the grounding blade member. However, since it is customary to provide the key projection on the grounding blade where such a grounding blade is included only that configuration has been illustrated, it being understood that the invention is not limited to grounding blades.

Each of the blade members is internally connected in a conventional manner to an electrical wire of an electrical cable (not shown). The ends of the wires are received in the male device and wired to the contact blades, and the cable is retained by means of the clamping means, generally indicated at **20**. The female device **12** includes two line blade receiving contacts **22** (one shown) for receiving the line blades, **14, 16**, and one grounding contact **24** receiving the grounding blade **18**. The female device **12** includes a closure member **26** having three slots, **28, 30, 32**, (FIG. **4**) defined

therethrough for insertion of the blades, 14, 16 and 18, into the female device. The female device, likewise, is provided with clamping means 34 for clampingly retaining the end of an electrical cable (not shown) to the device 12. As shown in FIG. 2, the female device 12 defines a plurality of elongated chambers (two shown), 36, 38, within its housing 40 for accommodating the contacts, 22, 24. At their upper ends, the chambers are bounded by the closure member 26 and, at their lower ends, the chambers are enclosed by a contact retaining cap 42. Connecting the housing 40 with the closure member 26 and the cap 42 are a plurality of screw members 44.

As clearly shown in FIGS. 2 and 3, the grounding contact 24 is a spring assembly including a generally V-shaped inner spring 46 and a generally planar outer spring 48. The inner spring 46 is seen to comprise a transition area 50 in which it changes from its V-shape into a flat portion 52. This portion is connected to the lower end 54 of the outer spring 48 by means of a rivet 56. The transition area 50 defines a clearance 58 between the inner and outer springs 46, 48. The outer spring 48 may be arranged such that approximately one half of its planar surface is cut away to the center line constituting an edge 60 on the outer spring. The lowermost end 62 of the outer spring is retained in the contact retaining cap 42 in any conventional manner. The end 62 includes a binding screw 64 and a clamping nut 66 arranged to connect a wire end (not shown) entering the chamber 38 via a slot 68 provided in the cap 42. Access to the screw 64 is provided by means of a recess 70 in the cap 42. At their uppermost ends, both the inner and outer springs are outwardly directed to facilitate insertion of the grounding blade 18.

In inserting the grounding blade 18 into the contact 24, via the slot 32, initially the upper ends of the inner and outer springs, which normally clampingly abut each other, are separated and the blade 18 with its usual interlocking flag 18' and the key projection 19 formed at one side and end of the flag 18' is introduced into the clearance 58. Such insertion of the blade and its flag portions continues until the lower surface 74 of the male device 10 is seated on the upper surface of closure member 26, shown in FIG. 2. In this condition, also the line blades, 14, 16, are received in their respective chamber in the female device 12, as illustrated in FIG. 4. As shown in solid lines in FIG. 5, the connector is in unlocked condition, as the blade flags are out of engagement with the usual connector body portions with which they are arranged to interlock. Upon rotation of the male device 10 in a clockwise direction relative to the female device 12 to the dotted line position, the flags engage inner wall portions of the closure member 26 adjacent the slots 28, 30 and 32 to interlock the connector in the usual way. In this condition, the male and female devices are in interlocked and grounded position and can not be separated without reverse relative rotation to their original positions. Throughout the relative movement to interlock or unlock the devices, the key projection 19 is free to move because of the unique configuration of the inner and outer springs, and unobstructed by the latter.

The inner and outer springs, 46, 48, shown in FIGS. 6, 7 and 8 are similar to those incorporated in the construction of FIG. 1. The blades, 78, 80, 82, however, are different in that their key projections are positioned at different locations on the flags of the blades.

In FIG. 6, for example, the key projection 79 is positioned at the opposite side and at the other end of the flag of blade 78, relative to the key projection position shown in FIG. 5. However, a positive contact is provided between the inner and outer springs and the blade 78 regardless of the position of the key projection on the blade and clearance for the key projection is provided in its movement of the flag 78' between solid line unlocked to dotted line locked positions.

As shown in FIG. 7, the key projection 81 on flag 80' of blade 80, is located at a different point on the flag 80' and is free to move between its solid line unlocked and dotted line locked positions.

The arrangement of FIG. 8 is similar to that of FIG. 6 with the exception, however, that the key projection 83 is positioned at a different location on the blade 82. A positive contact is established between the inner and outer spring, 46, 48, and the blade 82 and the key projection 83 is free to move when the blade flag 82' moves between its solid line unlocked and dotted line locked positions. It is apparent from the configurations illustrated in FIGS. 6–8 that the outer spring member 48 need not be cut away to the center line depending on the location of the key projection and the relative position of the slots in the closure member to the contacts. It is also apparent that the relative position of the V-shaped and planar springs may be reversed thereby rendering the V-shaped spring as the outer spring member and the planar spring as the inner spring member or that both spring members may be V-shaped.

The improved female contact construction permits the economical use of a common part in a plurality of different connector devices having different key projection dispositions on male locking contact blades. The unique configuration of the inner contact spring provides sufficient stiffness, because of its V-shaped form, so that increased contact pressure is produced when using relatively thin metal and without depending upon support from surrounding structural parts. Furthermore, it equals or exceeds the current carrying capacity of conventional springs and may be used in combination with various types of outer springs in both line and ground contact assemblies in connectors, receptacles or outlets of many different ratings and in two, three, four or five wire devices.

As other modifications and applications of the present invention, which do not depart from the essence thereof, will occur to those skilled in the art upon perusing the drawings and specification, the invention should be limited only by the attached claims.

What is claimed is:

1. In an electrical connector device, a housing, a plurality of chambers defined within said housing, means providing access into said housing, and a plurality of female electrical contacts within said chambers, at least one of said female electrical contacts including first and second spring members interconnected at one end and separable from each other at their other end for receiving a male contact, one of said spring members being V-shaped to permit free movement of a male contact between said members even if the male contact includes keying projections along the sides thereof.

2. The connector device as defined in claim 1, wherein said first and second spring members together define a center line and one of said spring members includes a rounded portion directed outwardly from said center line for constituting a void between said members.

3. The connector device of claim 1 wherein said one female contact is configured so as to operatively cooperate with different male contacts having keying projections formed at different locations on them.

4. The connector device as defined in claim 1, wherein said V-shaped spring member includes a main body of generally V-shaped configuration in cross-section, an end portion of generally planar configuration, and a curved transition area between said main body and said end portion, said end portion being connected to the second of said spring members at said one end of said members, and said curved transition area defining a void between said members.

5. The connector device as defined in claim 1, wherein said V-shaped spring member terminates in a flat portion interconnected with the second of said spring members at said one end of said members, and wherein said second of said members includes a generally planar main body having a center line and a portion cut away to the center line.

6. The connector device as defined in claim 5, wherein said second of said spring members includes a terminal portion and a binding screw and clamping nut carried by said terminal portion.

7. The connector device of claim 1 wherein said access means includes a slot disposed adjacent to said one spring member; a radial extension on said slot to provide a key opening; said male contact includes a lateral flag arranged to pass through said slot and underly said access means after the male contact has been inserted into the slot and moved relative to it; a keying projection on said flag arranged to pass through said key opening to permit entry of only selectively controlled male contacts; and said one spring member, because of its V-shaped cross-section, permitting different male contacts with key projections disposed at a plurality of alternative locations on said male contact to be inserted into said female contact and be moved between unlocked and interlocking positions without obstructing movement of the key projection.

8. The connector device of claim 1 wherein said other of said spring members includes a main body of generally V-shaped configuration.

9. A contact assembly, comprising first and second spring members interconnected at one end and separable from each other at their other ends for operatively receiving a male contact, one of said spring members being V-shaped to permit free movement of a keying projection on a male contact that is received between said members, regardless of which side said keying projection is located on said male contact or in which direction said keying projection protrudes.

10. The contact assembly as defined in claim 9, wherein said V-shaped spring member includes a main body of generally V-shaped configuration, an end portion of generally planar configuration, and a curved transition area between said main body and said end portion, said end portion being connected to the second of said spring members at said one end of said members.

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