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3,176,259

CONNECTOR

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FIG. 1

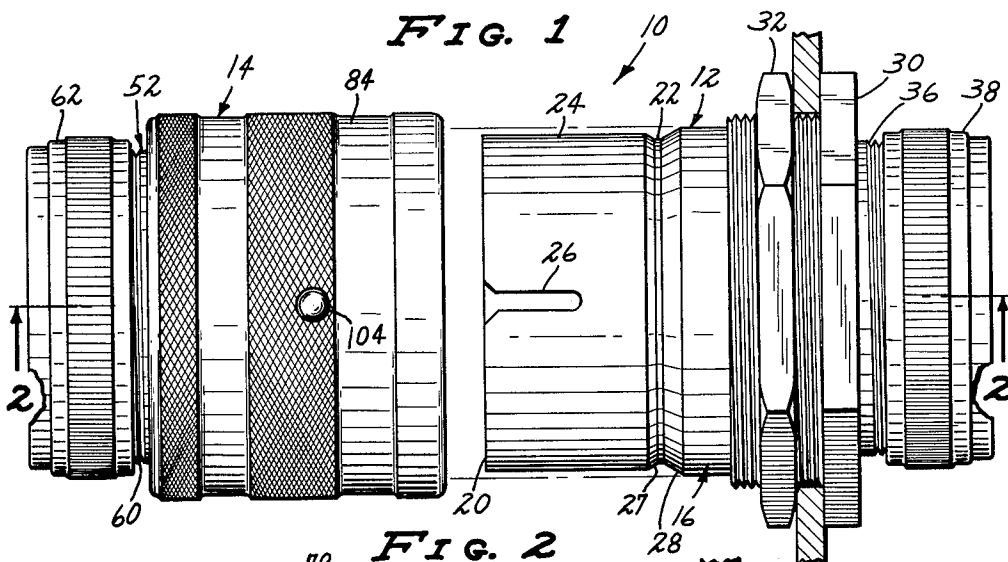


FIG. 2

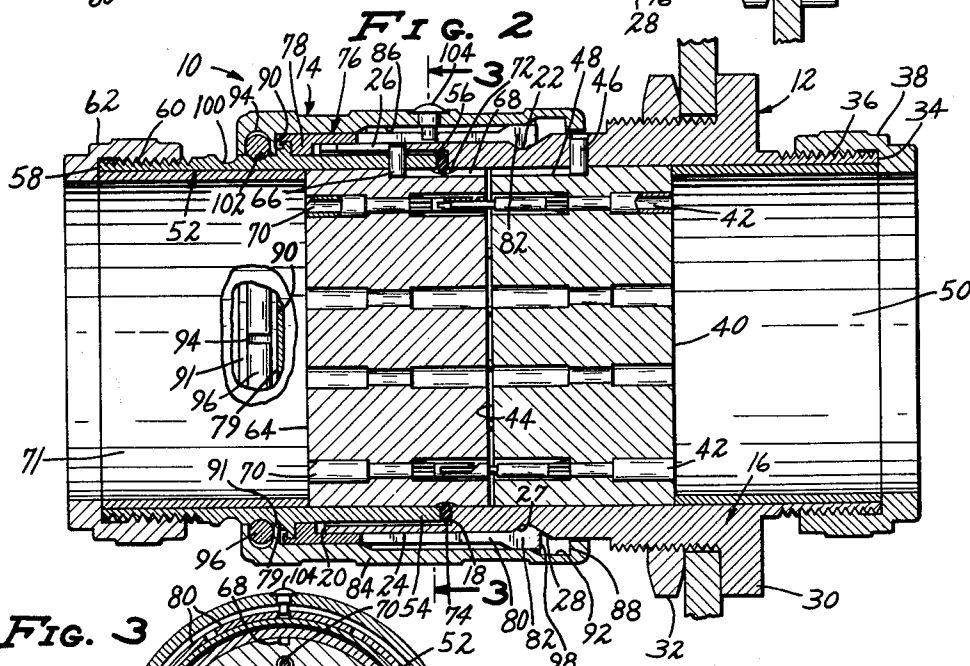
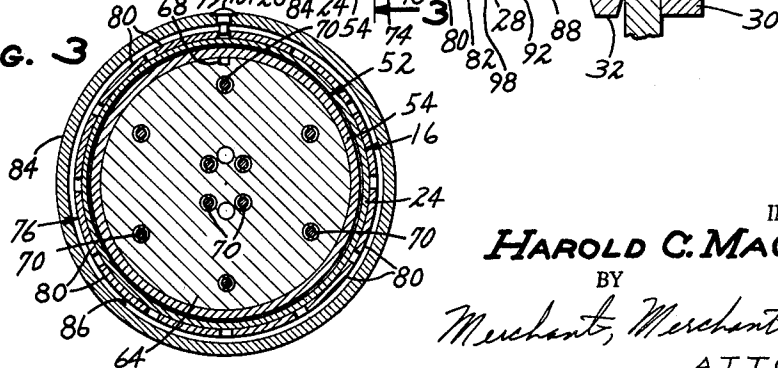


FIG. 3



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1 Claim. (Cl. 339-91)

This invention relates to new and very useful electrical connectors. More particularly, this invention relates to improvements in connectors of the type having interlocking plug and receptacle assemblies adapted for connection in aligned non-rotative relationship and in which each of said assemblies includes a plurality of connector elements connectable only in a given indexed relationship.

It is a principal object of this invention to provide a connector in which each of the pair of members or assemblies comprising such connector has an axis which may be axially aligned with the other so as to permit a connection and interlocking with simple manual movements, and also in which novel means is provided for positively locking the assemblies in their connected position against endwise or axial movement.

It is another object of this invention to provide a connector of this class suitable for coupling electrical wires.

It is another object of this invention to provide a coupling device utilizing a collet which is connected with one member of the coupling device and which is interlockable with the other.

It is another object of this invention to provide a coupling comprising a pair of cooperating connector elements in which such elements are interlocked by means of a collet and a slidable sleeve circumscribing such collet.

It is another object of this invention to provide a coupling device for electrical wires in which the wires are held in fixed relationship to one another in a sealed environment.

It is a further object of this invention to provide a means for yieldingly holding a collet locking sleeve so that it can positively hold the collet in either an interlocked or non-interlocked position.

Other and further objects of this invention will become apparent to those of ordinary skill in the art from a reading of the attached specification taken together with drawings wherein:

FIG. 1 is a side elevational view of a novel connector embodiment of the invention in a noncoupled position; some parts thereof being broken away and some parts shown in section.

FIG. 2 is an axial section passing from the line 2-2 of FIG. 1; some parts thereof being broken away.

FIG. 3 is a view in section as seen from the line 3-3 of FIG. 2.

Turning to the figures there is seen a connector herein referred to in its entirety by the numeral 10 which comprises a plug assembly 12 and a receptacle assembly 14. The plug 12 includes a tubular body 16 which is formed to provide an annular internally projecting shoulder or ledge 18 which is axially inwardly spaced from the forward end 20 of plug 12. Exteriously is placed a radially outwardly opening circumferential groove 22.

Groove 22 is formed in spaced relation to forward edge 20 of plug 12 and physically is located in back of or behind shoulder 18. The region between shoulder 18 and forward end 20 of plug 12 can be considered as a tubular shroud 24 which, in effect, is forwardly axially positioned on the tubular body 16 of plug 12. An axial key slot 26 extends inwardly from the forward edge 20 of plug 12. The rear wall of the groove 22 defines a generally annular rim 28 surface which extends generally

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radially outwardly and rearwardly. The mid-region of plug 12 defined an integrally formed six-sided flange 30 which provides a convenient station for attaching wrenches or the like used in mounting or demounting plug assembly 12. Immediately forward of hexagonally sided flange 30 the exterior wall of plug 12 is threaded and fitted with a mating nut 32. Flange 30 and nut 32 provide means for securing, if desired, the plug body 12 in a wall or partition or frame or the like in or around electrical apparatus.

The rear portion 34 of plug 12 is threaded on its adjacent outside surfaces 36 for receipt of a threaded collar 38.

In the interior of plug 12 is positioned a preformed plug component 40. While the plug 12 and the receptacle 14 can be formed of any conventional material it is preferred that they be formed of metal, especially a light metal such as magnesium or preferably aluminum. The plug component 40 is formed of electrically insulating material such as Bakelite, nylon, resin or similar plastic material which is electrically nonconductive.

Mounted in the plug component 40 are a plurality of electrically conductive plug elements 42, the forward ends of which extend through the front 44 of plug component 40. In the wall of plug 12 is mounted a key 46 and axially extending along a cylindrical wall of plug component 40 is a key slot 48 which mates with key 46. Thus when the plug 12 is assembled, the procedure is to insert cylindrical plug component 40 through the rear 34 of plug 12, the key slot 48 on plug component 40 and being aligned with key 46 in the wall of plug 12. Then a sleeve 50, whose outside diameter permits the same to slip into the cylindrical interior of plug 12, is pushed into place against plug component 40. Then collar 38 is screwed over the threaded sides 36, thereby fixing position of plug component 40 inside plug 12.

The receptacle 14 has a tubular shell 52 whose front end portion 54 when moved axially relative to plug 12 telescopically fits within the inside wall of shroud 24. The forward end 56 of receptacle tubular shell 52 approaches the shoulder 18. The rear end portion 58 of tubular shell 52, like the rear end portion 34 of plug 12, has its adjacent outside surfaces 60 threaded. Then a threaded collar 62 can be screwed onto the surfaces 60. For the interior of tubular shell 52 there is provided a receptacle component 64 which is in cylindrical form like plug component 40 and adapted to be slid forwards from the rear 58 of shell 52. A key 66 is positioned in the wall of shell 52 which mates with a key slot 68 which axially extends back from a front edge of receptacle component 64 along a wall thereof so that when key 66 and key slot 68 are aligned, receptacle component 64 can be simply slid in and forward from the rear end 58 of the tubular shell 52. The receptacle component is constructed of a material like that used in the plug component and is fitted with receptacle elements 70 mating with the plug component 40 in a given indexed relationship maintained by the reception of the key 66 of the shell 52 in the slot 26 of the tubular body 16 and by the reception of the keys 46, 66 in slots 48, 68 of the components 40, 64.

The receptacle component 64 is allowed to extend beyond the forward end 56 of tubular shell 52 so as to actually fit into the body 16 of plug assembly 12. Preferably the inside diameter of tubular shell 52 is equal to that of body 16. Circumferentially positioned about receptacle component 64 at the point where receptacle component 64 leaves the forward end 56 of tubular shell 52 is positioned a groove 72. This groove 72 provides a convenient resting place for an O-ring 74 which fills the gap when plug assembly 12 is telescopically engaged with receptacle assembly 14 between shoulder 18 and forward end 56 thereby providing a seal between the plug assem-

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bly 12 and the receptacle assembly when these respective assemblies are compressed together. The means for securing receptacle component 64 in fixed relationship to the inside walls of tubular shell 52 is like that used to secure plug component 40 in tubular body 16. Thus, a sleeve 71 whose outside diameter is only slightly less than the inside diameter of shell 52 is chosen. The length of this sleeve 71 is chosen so as to cause receptacle component 64 to project forwards beyond the forward end 56 of shell 52 as described. The sleeve 71 is held in place by the threaded collar 62.

A collet herein generically referred to by the numeral 76 encompasses tubular shell 52 and is rigidly secured thereto rearwardly of the front end portion 56 (i.e., just behind the region where the forward wall of shell 52 telescopically engages the forward wall of tubular body 16). Collet 76 includes a base ring 78 and spring fingers 80. It is base ring 78 which is rigidly secured to tubular shell 52 as by pressure-fitting, spin-fitting, or other conventional metal working technique.

The plurality of spring fingers 80 are circumferentially spaced from one another and extend axially forwardly from the base ring 78. It is the proximal ends of these spring fingers 80 which connect with base ring 78. The distal ends of the spring fingers 80 are formed into heads 82 which protrude radially inwardly and are of a size and configuration corresponding to the groove 22 in the body 16. The shanks of spring fingers 80 (i.e., the portion which connects the distal end with the proximal end of spring fingers 80) bias the distal ends outwardly and the ring of the shanks is such as to position the distal ends laterally for camming engagement of the heads 82 of spring fingers 80 with the front wall 27 of groove 22 in tubular body 16 when the plug assembly 12 is engaged with the receptacle assembly 14. In other words, the spring fingers 80 of collet 76 encompass the tubular body 16 when the plug assembly 12 is engaged with the receptacle assembly 14. The free ends or heads 82 of spring fingers 80 are disposed to be received in groove 22 but, initially, such heads are biased radially outwardly from groove 22.

A tubular actuator sleeve 84 axially slideably encompasses collet 76. Sleeve 84 has an annular internally projecting shoulder 88 normally disposed in forwardly spaced relation to the front ends of spring fingers 80. Sleeve 84 has an inner collet finger engaging portion 86. This collet finger engaging portion 86 is responsive to axial movement of sleeve 84 in one direction to move the independent front ends of the respective fingers 80 against the yielding bias thereof into groove 22 thereby locking shell 52 against any axial movement away from tubular body 16 because of the correspondence in size and shape of the heads 82 and the groove 22. Forward movement of sleeve 84 during such an interlocking operation is limited by an annular internally projecting shoulder 90 positioned at the rear of sleeve 84. This shoulder 90 butts up against the bottom 79 of base ring 78. Rotational movement of sleeve 84 relative to collet 76, or vice versa, is prevented by means of pin 104 which extends through a wall of sleeve 84 into a slot, usually the slot between a pair of spring fingers 80, thereby preventing rotational movement of one member in relation to the other. The pin 104 is conveniently peened over on the outside wall of sleeve 84.

When it is desired to unlock shell 52 from body 16, sleeve 84 is moved in the opposite direction toward the rear 58 of shell 52 permitting the spring fingers 80 of collet 76 to move radially outward away from the groove 22. Radial movement of collet heads 82 is limited by an internal annular recess 92 disposed rearwardly of forward shoulder 88. Recess 92 is adapted to receive the distal ends of the radially outwardly protruding heads 82 of spring fingers 80. It is in this configuration, that is with heads 82 positioned in recess 92, that the plug assembly 12 may be disengaged with the receptacle as-

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sembly 14. When sleeve 84 is slid forward so as to converge said collet fingers 80 as a group into camming engagement with front wall portions 27 of groove 22, O-ring 74 is slightly compressed thereby effecting the above described seal between shell 52 and body 16.

In the embodiment shown, shell 52 is equipped with a pair of axially spaced peripheral grooves 100 and 102, respectively, disposed rearwardly of front end portion 54 of shell 52 behind the position where the collet 76 is rigidly secured to shell 52. The distance between these grooves 100 and 102 (measured, say, from center to center) corresponds to the distance necessary for the sleeve 84 to travel in moving the collet spring fingers 80 from disengagement to engagement with groove 22, and vice versa. On the inner face 91 of shoulder 90 (i.e., the area of shoulder 90 which normally opposes the outside wall of shell 52) is positioned a recess 94 adapted to receive a split ring 96 which serves to yieldingly lock sleeve 84 into engagement with shell 52 in two distinct positions. In one position split ring 96 rests in groove 100 and the cam spring fingers 80 are disconnected from locking engagement with groove 22. In this position shoulder 88 at the other end of sleeve 84 is in such a position that the forward ends 98 of the respective heads 82 butt up thereagainst. In the other position split ring 96 rests in groove 102 (as shown in FIG. 2) and collet heads 82 are interlocked with groove 22 and the bottom or rear portion 79 of collet base ring 78 abutts shoulder 90. The purpose of split ring 96, then, is to provide a positive two-position action for sleeve 84 so that when sleeve 84 is in its forward position, the sleeve is in a semi-rigid position which resists accidental rearward displacement of sleeve 84 thereby disengaging collet heads 82 from groove 22. The reverse position serves to prevent lateral movement between collet 76 and sleeve 84 to prevent accidental locking of spring finger heads 82 in grooves 22.

In summary, this invention relates to a connector comprising a pair of cooperating connector assemblies. One of these assemblies includes a tubular body being formed to provide an annular inner shoulder axially inwardly spaced from one end thereof, and a radially outwardly opening circumferential groove in its outer surface.

The other of these assemblies includes a tubular shell having a front end portion telescopically receivable within said one end of said tubular body; a collet encompassing said shell and rigidly secured thereto rearwardly of the front end portion thereof, said collet including a plurality of circumferentially spaced axially forwardly extending spring fingers which encompass said one end of said body when said shell is received therein, the free ends of said fingers being yieldingly biased radially outwardly and disposed to be received in said groove; a tubular actuator sleeve axially slidably encompassing said collet; said sleeve having an inner collet finger engaging portion responsive to axial movement of said sleeve in one direction to move the front ends of said fingers against the yielding bias thereof into said groove, whereby to lock said shell against axial movement away from said body; said sleeve defining an internal annular shoulder normally disposed in forwardly spaced relation to the front ends of said fingers and engaging the front ends of the fingers upon movement of said sleeve in the opposite direction to withdraw said shell from said body; means limiting movement of said sleeve in said one direction relative to said collet; and a sealing ring interposed between the front end of said shell and said annular inner shoulder and having sealing engagement with said shell and shoulder when the shell is received in said tubular body.

In preferred embodiments of the invention, the said shell has a pair of axially spaced outwardly opening grooves disposed rearwardly of said front end portion, the space between said grooves being equal to the distance that said sleeve moves in engaging said collet fingers with said radially outwardly opening circumferential groove,

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and said sleeve has its rear inner surface grooved to receive a split ring whereby forward and backward movements of said sleeve are positively controlled.

Also in preferred embodiments, the connector has a tubular body having an axial key slot inwardly extending from the front end thereof and said shell has a key positioned in its front end portion interlocking with said key slot of said tubular body.

Further, in preferred embodiments, the connector has a key slot in its collet interlocking with a key protruding from an inner wall of the encompassing sleeve thereby preventing rotational movements of the collet relative to the sleeve.

My invention has been thoroughly tested and found to be completely satisfactory for the accomplishment of the above objects, and while I have shown and described a preferred embodiment, I wish it to be specifically understood that the same is capable of modification without departure from the spirit and scope of the appended claim.

I claim:

In a connector of the type having a pair of cooperating connector assemblies adapted for connection in aligned non-rotative relationship and in which each of said assemblies includes a plurality of connector elements connectable with the connector elements of the other assembly only in a given indexed relationship,

(a) one of said assemblies comprising a generally tubular body carrying the connector elements for said one assembly and having one open end and formed to define radially outwardly opening generally circumferential groove means in its outer surface,

(b) the other of said assemblies comprising:

- (1) a tubular shell carrying the connector elements for said other assembly and having a front end portion telescopically receivable within said open end of said tubular body to define a connected position thereof,
- (2) a collet encompassing said shell and secured thereto, said collet including a plurality of circumferentially spaced axially forwardly extending spring fingers which encompass said one open end of the body of said one assembly when

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said shell is received therein, the free end portions of said fingers defining radially inwardly projecting heads having radially inner surfaces of a size and configuration corresponding to said groove means in said one assembly and said fingers being yieldingly biased radially outwardly and disposed for engagement of said surfaces of said heads in said groove means of the one assembly when said tubular shell is in its connected position relative to the tubular body of said one assembly,

(3) a tubular actuator sleeve of materially greater length than said collet and its spring fingers axially slidably encompassing said collet and continuously completely enclosing said collet, and

(4) said sleeve having an inner collet-finger-engaging portion responsive to axial movement of said sleeve in one direction to move the projecting heads of said fingers against the yielding bias thereof to cause and maintain said engagement of said head surfaces with said groove means whereby to lock said shell of said other assembly against axial movement with respect to the body of said one assembly, said sleeve further having an internal annular shoulder normally disposed in forwardly spaced relation to the front ends of said fingers and engaging the front ends of said fingers upon movement of said sleeve in the opposite direction to withdraw said shell from said body.

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