Jan. 3, 1967 R. NEIDECKER 3,296,575

ELECTRICAL CONNECTOR OF THE PLUG-AND-JACK TYPE

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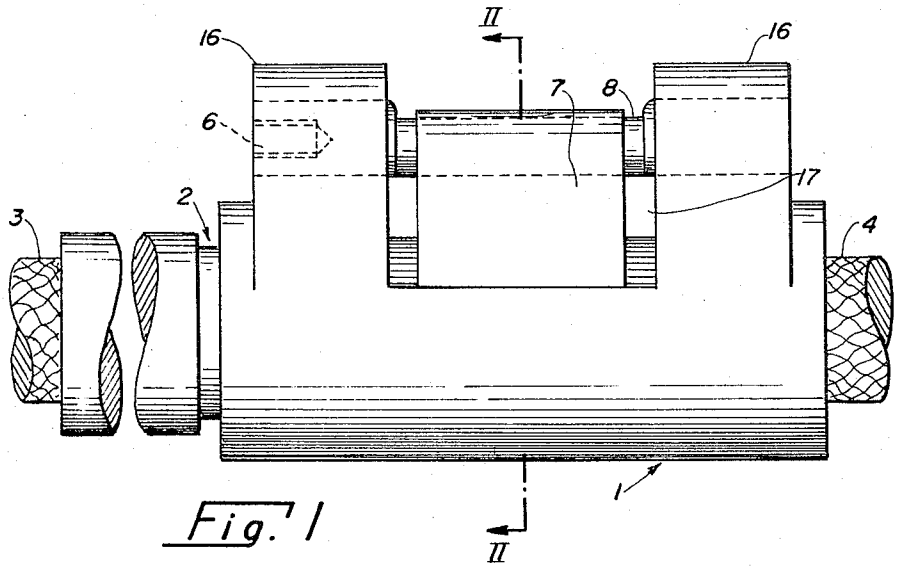


Fig. 1

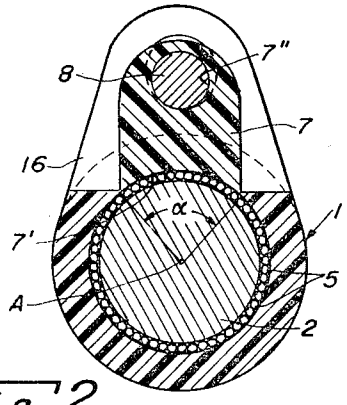


Fig. 2

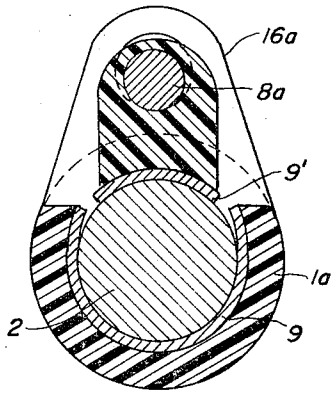


Fig. 3

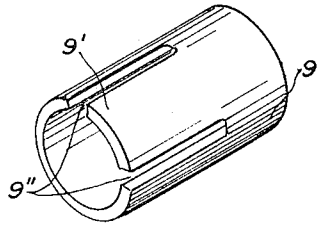


Fig. 4

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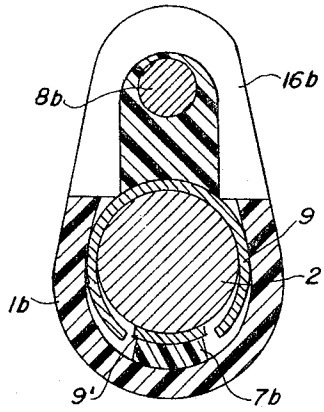
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ELECTRICAL CONNECTOR OF THE PLUG-AND-JACK TYPE

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Fig. 5



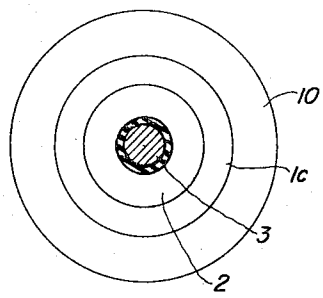


Fig. 8

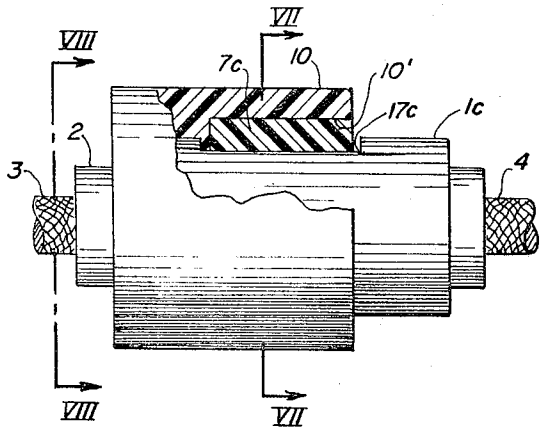


Fig. 6

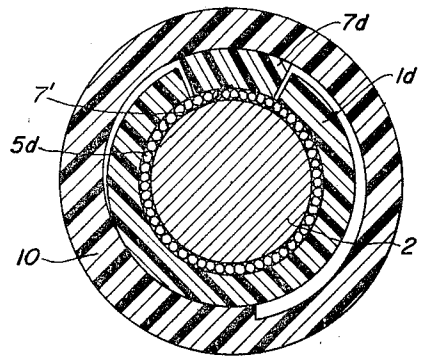


Fig. 9

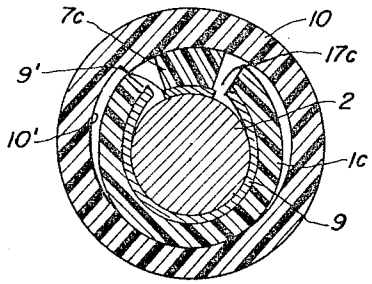


Fig. 7

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United States Patent Office

3,296,575

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ELECTRICAL CONNECTOR OF THE PLUG-AND-JACK TYPE

Rudolf Neidecker, Basel, Switzerland, assignor to Multi-Contact A.G., Basel, Switzerland, a corporation of Switzerland

Filed Oct. 6, 1965, Ser. No. 493,470
6 Claims. (Cl. 339—75)

This application is a continuation-in-part application of my prior application Ser. No. 220,528, filed August 30, 1962, now patent No. 3,214,721, issued October 26, 1965.

My present invention relates to an electrical connector consisting of a male member or plug and a female member or jack releasably engageable with each other.

In my prior application and patent, identified above, I have disclosed a connector of this type whose female member has a longitudinal bore lined with a tubular array of contact springs engageable with a conductive surface of the associated male member, some of the contact springs being radially deflectable by a biasing element such as a flexible strap under the control of a crankshaft rotatably mounted on the female member. The crankshaft acts as a setting means which by its operation urges the engaged contact springs under increased clamping pressure against the cylindrical male member whereby the latter is held in tight mechanical and electrical contact with the female member.

In the arrangement specifically claimed in my aforementioned patent, the segment of the array of contact springs engaged by the crankshaft-operated biasing means is located on a side diametrically opposite the crankshaft. Such relative positioning of the setting and biasing means, however, will not be convenient in every instance; an object of the present improvement, therefore, is to provide a modified connector in which a more compact structure can be realized by locating the biasing means on the same side of the connector axis as the crankshaft.

Another object of the present invention is to provide an advantageous alternative to a rotatable crankshaft leading to an even more compact construction of the connector as a whole.

It is also an object of this invention to enable the elimination of the aforedescribed contact springs in a jack adapted to be selectively biased against a mating plug by a crankshaft or other setting means.

In accordance with a feature of the present invention I provide a female member having the shape of a tube of conductive material (e.g. a metal or a metal-coated resin) integrally formed with a radially inwardly deflectable tongue, this tongue being in direct or indirect contact with a crankshaft or other eccentric, rotatably mounted on the female member, so as to be cammed into firm engagement with the inserted male member when the eccentric is rotated from an unoperated position into a clamped position.

The eccentric, according to another feature of my present invention, need not be disposed alongside the tubular portion of the female member but may rotatably surround this portion, being thus in the shape of a sleeve

formed with a spiral camming groove which in certain rotary positions bears upon the deflectable tongue through an interposed pressure element. A sleeve-type setting means may, however, also be used in combination with a tubular array of contact springs forming part of the female member in the manner described above.

According to still another feature of my invention, applicable in the presence of such an array of contact springs, the interposed pressure element has a cylindrically concave contact surface engaging a plurality of the springs for concurrently deflecting them in a generally radial direction toward the axis of the array, this surface being substantially coaxial with the array and extending over an arc somewhat less than 180°, preferably between about 60° and 120°. It will be apparent that a pressure element of this description can be used with either a camming sleeve or a crankshaft serving as the eccentric setting means.

The invention will be described in greater detail hereinafter with reference to the accompanying drawing in which:

FIG. 1 is a side-elevational view of an assembled plug-and-jack connector according to the invention;

FIG. 2 is a cross-sectional view taken on the line II—II of FIG. 1;

FIG. 3 is a cross-sectional view similar to FIG. 2, showing a modification;

FIG. 4 is a perspective view of a female member forming part of the structure of FIG. 3;

FIG. 5 is another view similar to FIG. 2, illustrating a further embodiment;

FIG. 6 is a side view similar to FIG. 1, with parts broken away, illustrating still another embodiment;

FIGS. 7 and 8 are sectional views taken on the lines VII—VII and VIII—VIII, respectively, of FIG. 6; and

FIG. 9 is a cross-sectional view similar to FIG. 7, illustrating yet a further modification.

The connector shown in FIGS. 1 and 2 comprises a female member or jack **1** and a male member or plug **2** removably received therein. Jack **1** is generally in the shape of a cylindrical sleeve with two peripherally projecting lugs **16** axially spaced from each other and with a peripheral gap **17** between these lugs. The plug **2** is also of cylindrical configuration and, as here shown, may be a solid metallic rod; one of its extremities is conductively connected, in conventional manner not further illustrated, to a flexible cable **3** while a similar cable **4** is connected to the conductive portion of jack **1** represented by a tubular array of contact springs **5**. The springs **5** extend axially within the preferably non-conductive housing portion of jack **1** to which they are anchored on opposite sides of the gap **17**; they may be slightly bent inwardly, i.e. toward the common axis of members **1** and **2**, so as to bear with moderate pressure upon the surface of plug **2** when the latter is inserted into jack **1**.

A pressure block **7**, also shown to be made of insulating material, has a cylindrically concave surface **7'** centered on the common axis A of members **1** and **2**, this surface extending over an arc α here shown to be approximately 90°. Block **7** has a bore **7''** traversed by a crankshaft

8 which is journaled in the lugs 16 and may be manually rotated with the aid of, for example, a suitable key (not shown) insertable into a polygonal socket 6 thereof. In the clamping position illustrated in FIGS. 1 and 2, crankshaft 8 forces the block 7 downwardly so that all the springs 5 in contact with surface 7' are urged generally radially onto the plug 2; this pressure also shifts the plug toward the opposite segment of the array of springs 5 so that the plug is firmly gripped by these springs both above and below the axis. Moreover, the pressure of block 7 passing through the gap 17 tends to deform the cylindrical body of jack 1 so that the laterally positioned springs also are urged into firmer contact with plug 2. A dependable electrical and mechanical connection is thereby established between the two members.

In FIG. 3 I have shown a plug 2 received in a jack 1*a* which differs from the jack 1 of the preceding embodiment by the fact that its contact springs 5 have been replaced by a metal tube 9 formed with an integral resilient tongue 9'; as best seen in FIG. 4, which shows the tube 9 removed from the rest of the assembly, tongue 9' is separated from the remainder of the tube 9 by two longitudinal incisions 9'' defining between them a peripheral gap. A crankshaft 8*a*, again journaled in axially spaced lugs 16*a* of the jack, exerts generally radial pressure upon the tongue 9' in its illustrated operative position; it will be apparent that the results of this clamping action is again a tight contact between the male member 2 and the associated female member 1*a*.

FIG. 5 represents a reversal of the embodiment of FIG. 3 in that the tongue 9' of the tube 9 is now positioned at a location diametrically opposite the crankshaft 8*b* journaled in lugs 16*b* of a female member 1*b*. A pressure block 7*b* is interposed between the closed bottom wall of the outer tubular body of member 1*b* and the tongue 9'. Again, in the illustrated clamping position, crankshaft 8*b* relatively displaces the members 1*b* and 2 so that block 7*b* urges the tongue 9' into firm contact with the plug 2 even as the diametrically opposite portion of tube 9 is driven by the crankshaft 8*b* against the block.

In FIGS. 6–8 I have shown an assembly of a plug 2 and a jack 1*c* whose tubular body, formed again with a peripheral gap 17*c*, is surrounded by a rotatable sleeve 10 having part of its inner periphery formed as a spiral groove 10'. A pressure block 7*c* is interposed between the bottom of groove 10' and the tongue 9' of a slitted metal tube 9, again constituting the conductive portion of the female member. In the position best illustrated in FIG. 7, the short-radius portion of groove 10' registers with block 7*c* so that the latter deflects the tongue 9' against the plug 2 to establish, as before, a tight mechanical and electrical connection between the two members. When the sleeve 10 is rotated (counterclockwise in FIG. 7) into an inoperative position, this connection is released. It should be noted that the end of sleeve 10 visible in FIG. 8, beyond the groove 10' is coaxial with the body of member 1*c* and rotatably supported thereon. The outside of sleeve 10 may be knurled or otherwise deformed to facilitate its manual rotation.

In FIG. 9, finally, I have shown the same sleeve 10 surrounding a female member 1*d* generally similar to member 1*c* except for the substitution of a tubular array of contact springs 5*d* for the slitted tube of the preceding embodiment. A pressure block 7*d*, bearing upon the bottom of spiral groove 10' of sleeve 10, engages several of the springs 5*d* in substantially the same manner as does the block 7 of FIGS. 1 and 2, i.e. through a cylindrical contact surface 7' centered on the axis of the array. In the illustrated operative position block 7*d* is cammed inwardly to urge the adjacent springs 5*d* into contact with plug 2 as described above.

As will be evident from the foregoing description, firm conductive contact could also be established between the two members if the pressure block 7, 7*c*, 7*d* of FIGS. 3, 7 and 9 were allowed to bear directly upon the plug 2, i.e. if either the tongue 9' or adjoining contact springs in the array 5*d* were omitted. Naturally, the extent of the area of conductive contact between the two members would be somewhat reduced in such a case so that the electrical resistance of the connector would be correspondingly increased.

It will thus be apparent that I have disclosed a variety of relatively compact connectors of the type described which can be readily locked in an engaged position and released therefrom for easy separation. Further modification are, of course, possible without departure from the spirit and scope of my invention as defined in the appended claims.

I claim:

1. A connector for electrically linking two conductors, comprising a conductive generally male member connected to one of said conductors, an at least partly conductive tubular female member connected to the other of said conductors, said male member being removably received in said female member, cam means rotatably mounted on said female member, the latter having a peripheral gap in line with said cam means, and means including a radially movable pressure element penetrating said gap for exerting upon said male member a transverse force urging same into firm contact with a diametrically opposite portion of said female member upon rotation of said cam means into a clamping position, said female member being formed with an integral tongue deflectably occupying at least part of said gap, said pressure element being interposed between said tongue and said cam means, said cam means comprising a sleeve surrounding said female member, said sleeve having an eccentric inner peripheral surface.

2. A connector for electrically linking two conductors, comprising a conductive generally male member connected to one of said conductors, an at least partly conductive tubular female member connected to the other of said conductors, said male member being removably received in said female member, cam means rotatably mounted on said female member, the latter having a peripheral gap in line with said cam means, and means including a radially movable pressure element penetrating said gap for exerting upon said male member a transverse force urging same into firm contact with a diametrically opposite portion of said female member upon rotation of said cam means into a clamping position, said female member including a nonconductive tubular body provided with said gap and an array of contact springs lining the interior of said body, some of said springs being interposed between said pressure element and said male member.

3. A connector as defined in claim 2 wherein said pressure element has a cylindrically concave contact surface engaging said interposed springs, said contact surface being substantially coaxial with said array.

4. A connector as defined in claim 3 wherein said contact surface extends over an arc ranging between substantially 60° and 120°.

5. A connector for electrically linking two conductors, comprising a generally cylindrical conductive male member connected to one of said conductors, a female member provided with a tubular array of conductive contact springs connected to the other of said conductors, and setting means including a sleeve rotatably mounted on said female member, said seleve having a generally spiral inner peripheral surface throughout at least part of its length, said setting means further including a radially movable pressure element which bears upon said peripheral surface and has a cylindrically concave inner surface engaging a plurality of said contact springs for transmission of a camming force thereto in a clamping position of said setting means to urge the engaged springs against said male member upon insertion of the latter into said female member.

6. A connector for electrically linking two conductors, comprising a generally cylindrical conductive male member, a female member provided with a tubular array of conductive contact springs, and setting means including a crankshaft rotatably mounted on said female member with an axis parallel to the axis of the latter, said setting means further including a radially movable element which is operatively coupled with said crankshaft and has a cylindrically concave inner surface engaging a plurality of said contact springs for transmission of a camming force thereto to urge the engaged springs against said male member in a clamping position of said crankshaft upon insertion of the latter into said female member.

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