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ELECTRICAL CONNECTOR

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10 Claims

ABSTRACT OF THE DISCLOSURE

A heavy duty plug and socket type electrical connector having a lever-actuated, linearly-movable component for engaging and disengaging the mating contacts and for releasably locking the separable connector parts together.

This invention relates to electrical devices and more particularly to connectors for separably connecting one or a plurality of electrical conductors.

An object of the present invention is to provide a novel constructed device for effecting a readily separable connection between adjacent ends of electrical conductors.

Another object of the invention is to provide an electrical connector embodying novel means for angularly orienting separable mating parts thereof.

A further object is to provide a novel electrical connector having separable mating parts which may be quickly and readily coupled and uncoupled.

Still another object is to provide a novel electrical connector wherein the mating parts of simplified construction are sturdily coupled together in a novel manner.

The above and further objects and novel features of the present invention will more fully appear from the following detail description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

FIG. 1 is an exploded sectional elevation view of one form of electrical connector embodying the invention;

FIGS. 2 and 3 are end elevation views of the separable connector units of FIG. 1, the views being taken, respectively, on lines 2—2 and 3—3 of FIG. 1; and

FIG. 4 is a bottom view, with parts broken away, of the connector unit shown at the left in FIG. 1.

The invention as illustrated in the drawings, by way of example, is embodied in a novel plug unit P and a receptacle unit R adapted to be mated with each other and separably coupled together. The coupling of said units is effected in a novel manner to facilitate quick and easy engagement and disengagement of the mating electrical contacts without danger of damage thereto and to provide an exceptionally sturdy but simple mechanical connection of the two units which insures against accidental disconnection from any cause.

In the form shown, the plug P is designed for connection to and mounting on the end of a flexible shielded cable and comprises a tubular casing 10 having diametrically disposed elongated openings 11 in opposed sides thereof for a purpose to hereinafter appear. At the forward (right in FIG. 1) or mating end of member 10, a semi-circular portion thereof is cut away or omitted from the upper half thereof, leaving an axially extending semi-circular projection which, in the form shown, may be reduced to a pair of oppositely disposed projections 12 having flat end surfaces 9 adjacent a horizontal plane containing the diameter of the casing as viewed in FIG. 2. For a purpose to hereinafter appear, a hole or recess 8 is drilled in the right-hand (FIG. 2) projection 12 perpen-

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dicular to the surface 9, and a pin 7 projects from the left-hand projection 12 perpendicular to the surface 9 thereof. The other sides of the units P and R are provided with similar but oppositely disposed recess 48 and pin 49.

A tubular adaptor or connector shell assembly has a close sliding fit within casing member 10 and in the specific form illustrated, comprises a tubular sleeve 14 and cylindrical shell 15 fitted in the counterbored forward end of the sleeve and maintained therein by threaded ring nut 16. Said sleeve and shell may be angularly oriented by any suitable known means, such as by the cooperating key and keyway at 17. An insulating contact supporting insert 18 is mounted in shell 15 and may be retained therein by any suitable means, such as by the cooperating annular flange and groove at 19. One or more socket contacts 20 of any suitable known construction may be mounted and retained in insert 18 in a known manner, such as by cooperating land and groove means.

Means are provided for imparting axial movement to sleeve 14 between predetermined limiting positions within casing member 10 and for releasably locking the same in said positions. Said means, as shown, comprises a lever or handle in the form of a bail 21 pivotally mounted on casing 10 by set screws 22. The bail is connected to sleeve 14 by a pair of links or straps 23, 23, each of which is pivotally secured to the bail by a screw or rivet 24 and to sleeve 14 by a screw 25 surrounded by a cylindrical spacer 26 between the strap and sleeve. Thus, by pivoting handle 21 counterclockwise as viewed in FIG. 1, sleeve 14 will be moved thereby toward the right from the illustrated full line position to the dotted line position in which the insert 18 and an end portion of sleeve 14 extend beyond the end of casing member 10 for mating relation with receptacle R in a manner hereinafter described.

The means for releasably locking sleeve 14 against axial movement relative to casing member 10 comprises a cup-like member 27 radially slidable in each of two axially spaced recesses 28 and 29 in the outer surface of sleeve 14 and urged radially outwardly by a coil spring 31. Casing member 10 has a radial passage 32 which is in longitudinal alignment with recesses 28 and 29 and has the same diameter. Thus, when passage 32 is in registry with either recess 28 or 29, the locking cup or detent 27 in the registering recess is moved radially outwardly by spring 31 partially into said passage for engagement with the rounded inner end of a push button 33. The outward movement of button 33 is limited by a strap 34 secured to casing member 10 by a set screw 35 and surrounding or straddling a reduced neck portion of the button. In order to move sleeve 14 and the connector elements assembled thereon from one limiting position to the other, it is necessary to depress button 33 until the area of contact thereof with detent cup member 27 is flush with the adjacent contacting surfaces of member 10 and sleeve 14. The latter may then be moved axially within member 10 by manipulation of handle 21 as described above.

One or more insulated conductors (not shown) may be led into the open end of sleeve 14 and connected to an equal number of contacts 20 in any known manner, such as by soldering or crimping. If desired, a shielding conduit for such conductors may be detachably connected in a known manner, such as by a coupling nut, to the threaded outer end 36 of sleeve 14.

The connector receptacle R in the form shown, by way of example, is designed for mounting on a bulkhead, casing wall, or the like and comprises a tubular casing member 40 which complements and mates with casing member 10 to form a continuous tube. A connector shell 41 is positioned in a counterbore in member 40 and maintained therein by threaded ring nut 42. Relative rotation of

member 40 and shell 41 is prevented by a cooperating key and keyway at 43. An insulating contact supporting insert 44 is mounted in shell 41 in any known manner and carries one or more contact pins 45 which are telescopically mateable with socket contacts 20 in plug P. If desired, a flanged sleeve 51 may be held in shell 41 by nut 42 to afford added protection for pin contacts 45 and to embrace the end of insert 18 when the plug and receptacle are coupled together.

Casing member 40 has an axially extending semi-circular or two-part arcuate extension or projection 46 at the end thereof which is diametrically disposed to and complements extensions 12 on member 10 when the two casing members 10 and 40 are mated end-to-end. Means are provided to interlock the projections 12 and 46 to thereby lock said casing members against axial separation when the same are mated in axial alignment. In the illustrated embodiment, such means consists of a pin 7 on a projection 12 which registers with and extends into a recess 48 in a projection 46 and a second pin 49 on the other projection 46 which registers with and extends into recess 8 in the other projection 12. Other equivalent means, such as mating ribs and grooves, may be provided on the mating surfaces of projections 12 and 46 in lieu of pins 7. Similarly, both pins 7 and 49 may be on the same connector unit for extending into openings in the other connector unit.

To couple plug P and receptacle R, the casing members 10 and 40 are first brought into end-to-end engagement and then moved relatively in a radial direction into coaxial alignment with the projections 12 and 46 in abutment and interlocked by means of pins 7 and 49. Push button 33 is then depressed to release sleeve 14 for axial movement in casing member 10, and handle 21 is pivoted about pivot pins 22 in a counterclockwise direction as viewed in FIG. 1. Sleeve 14 and the connector assembly carried thereby are thus moved toward the right (FIG. 1) until the locking detent or cup in recess 29 registers with and enters passage 32. The inserts 18 and 44 are then preferably in face-to-face engagement, the pin and socket contacts 45 and 20 will be in telescopic engagement, and the right-hand end of sleeve 14 will be in telescopic relation with casing member 40. The internal bridging of the junction between casing members 10 and 40 by sleeve 14 holds the mating halves or units of the connector against relatively lateral or transverse movement while pins 7 and 49 prevent axial separation thereof. To provide a seal at the junction of the mating units, resilient O-rings 52 and 53 may be provided in annular grooves in members 10 and 40 to surround and engage sleeve 14 when the latter is in telescoped relation with casing 40 in connector engaging position.

The connector units P and R may be readily and quickly disengaged by merely depressing button 33 to release sleeve 14 and pivoting lever 21 in a clockwise direction, as viewed in FIG. 1, to restore the parts to the full line positions shown in FIG. 1.

Although only a single embodiment of the invention has been illustrated in the accompanying drawing and described in the foregoing specification, it is to be expressly understood that the invention is not limited thereto. For example, the socket contact 20 and its supporting insert 18 may be interchanged with pin contact 45, its supporting insert 44 and sleeve 51. It will be seen also that a unit P with socket or pin contacts may be coupled to a second identical unit carrying pin contacts or socket contacts, respectively. In the latter instance, coupling and uncoupling may be effected by operating the handle 21 on either of the units. Also, each of the mating units may have some socket contacts and some pin contacts, provided the supporting inserts and contacts complement each other and hence, mate in a manner known in the art. Equivalent locking means, such as mating tongues and grooves on projections 12 and 46, may be substituted for pin and recess connections 7, 48 and 49, 8. Various other

changes may be made in the details of construction and arrangement of parts illustrated, as will be readily apparent to persons of ordinary skill in the art, without departing from the spirit and scope of the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Electrical connector apparatus comprising first and second separable mateable units, said first unit including a tubular casing, an assembly mounted in said casing for limited axial movement relative thereto and means for moving said assembly between two limiting positions in said casing, said assembly comprising a tubular sleeve slidable in the casing, an insulating insert in said sleeve and an electrical contact carried by said insert, and said second unit including a tubular casing, an insulating insert in the latter and an electrical contact carried by said last-named insert, and interlocking means on said casings for locking the same against relative axial and relative rotary movement while permitting relative linear movement of the same transversely of their axes when the same are in axial alignment and end-to-end abutment, said assembly being movable by said means for moving when said casings are thus locked against relative axial and rotary movements to electrically engage said contacts with each other and to telescope an end portion of said sleeve into the casing of said second unit in close sliding engagement therewith, whereby said interlocking means and said sleeve cooperate to lock the casings against all relative movement independently of said contacts and insert.

2. Apparatus as defined in claim 1 wherein said interlocking means are integral with and fixed in relation to said casings.

3. Apparatus as defined in claim 1 wherein said interlocking means are rendered operative by relative movement of said casings transversely of the axes thereof while said assembly is in contact disengaging position.

4. Apparatus as defined in claim 1 wherein said interlocking means comprises mating elements on opposed, transversely-abutting semi-circular portions of the abutting ends of said casings.

5. Apparatus as defined in claim 1 wherein said interlocking means includes a transversely projecting pin on each of said casings, each said pin on one of the casings being adapted to slidably engage a transversely extending recess in the other of said casings.

6. Apparatus as defined in claim 1 wherein said means for moving said assembly comprises a handle pivotally mounted on said first-named tubular casing and a link pivotally connected to said handle and said sleeve.

7. Apparatus as defined in claim 1 comprising releasable locking means for locking the casing and assembly of the first unit against relative movement.

8. An electrical connector unit comprising a tubular casing, a tubular sleeve having a close sliding fit in said casing, a contact supporting insert secured in said sleeve, a contact mounted in said insert, means for moving said sleeve axially between two predetermined positions in said casing, said sleeve in one said position projecting outwardly beyond an end of said casing for telescopic close sliding relation with the casing of a mating connector unit, means integral with said first-named casing and cooperable with complementary means on the casing of such mating connected unit upon relative transverse linear movement of said casings for securing said units against axial separation and relative rotation when said sleeve is in its other said position, and means for releasably locking said sleeve to said first-named casing in only said two positions.

9. An electrical connector comprising first and second tubular casing members, an insulating contact supporting insert in each said member, at least one contact mounted in each said insert for mating relation with each other upon relative movement of said inserts axial-

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ly of said members, a rigid tubular sleeve axially slidable within said first casing member and surrounding and supporting one said insert, complementary extensions on and integral with adjacent ends of said members, said extensions being mateable by relative linear transverse movement of said casing members to axially align and angularly orient said members relative to each other and to hold said members in abutted end-to-end relation against relative axial and angular movement, and means for reciprocally moving said sleeve with said insert axially relative to said members between predetermined terminal positions for moving said contacts into and out of mating engagement while said members are thus held by said mated extensions, said sleeve in one of said terminal positions being within said first casing member and in said other terminal position extending from said first casing member, through said mated extensions and into said second casing member in close sliding telescopic relation therewith to lock the casing members against transverse separation.

10. An electrical connector unit comprising a tubular casing, a tubular sleeve having a close sliding fit in said casing, a contact supporting insert secured in said sleeve, a contact mounted in said insert, means for moving said sleeve axially between two predetermined positions in said casing comprising a handle pivotally mounted on

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said casing and a link pivotally connected to said handle and said sleeve, said sleeve in one said position projecting outwardly beyond an end of said casing for telescopic close sliding relation with the casing of a mating connector unit, and means for releasably locking said sleeve to said first-named casing in only said two positions.

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