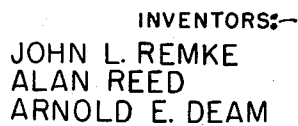


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ELECTRICAL CONNECTOR

Filed Oct. 2, 1959

2 Sheets-Sheet 1



BY :-

Marzall, Johnston, Cook & Root
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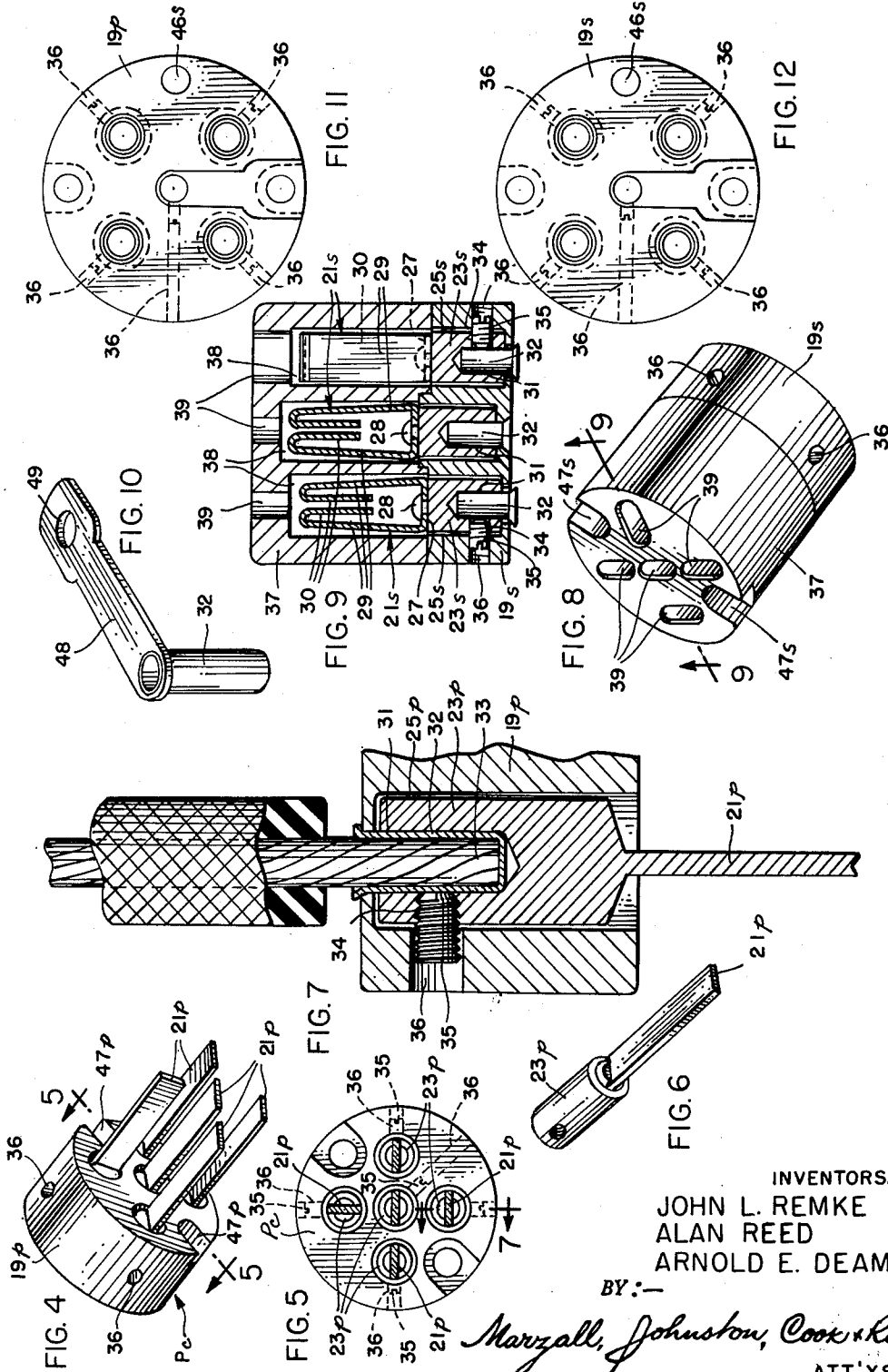
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3,046,512

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2 Sheets-Sheet 2



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3,046,512

ELECTRICAL CONNECTOR

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1 Claim. (Cl. 339-14)

The present invention relates in general to electrical connection or coupling devices and has more particular reference to quick detachable, multiple conductor plug and socket connectors.

An important object of the present invention is to provide a connector embodying plug and socket components comprising insulating bases, blade-like terminal electrodes forming coupling prongs mounted on the insulating base of the plug component, and terminal electrodes forming prong engaging contacts mounted on the insulating base of the socket component, wherein the blades and contacts are secured or formed on mounting blocks of identical sectional size and configuration and adapted for reception in correspondingly shaped pockets formed in the insulating bases of the plug and socket components of the connector; a further object being to size the mounting blocks for loose interfitment in their mounting pockets; a further object being to provide for anchoring the blocks rockably in the mounting pockets, as by means of a set screw extending in a channel or duct formed in the insulating base of the coupling component and opening radially upon the pocket, the set screw having an end threaded in a lateral socket formed in the mounting block; a still further object being to utilize the set screw not only for anchoring the mounting block in its pocket, but also to electrically connect the block with a corresponding electrical conductor, as by forming each block with a cavity sized to snugly receive the end of a conductor in position to be squeezingly anchored in said cavity, and electrically connected with the block by the clamping action of the inner end of the mounting set screw; yet another object of the invention being to provide a metallic ferrule of electrical conducting material in position to surround the conductor within the cavity, whereby said ferrule may receive the conductor clamping thrust of the set screw.

Another important object of the invention resides in mounting the plug and socket components of an electrical connector in metallic housing shells formed for relatively slidable telescopic interfitment when the plug and socket components are brought into relatively coupled relationship, the components being provided with means for connecting at least one of the circuit forming terminal electrodes thereof with the metal shell in which the component is anchored; a further object being to secure the insulating base of each coupling component, as by means of fastening screws, upon integral, inwardly extending lugs formed in the component's mounting shell, the insulating base of each component carrying a strip of conducting material in position for electrical connection, at one end, with a said mounting lug of the housing shell, and, at its other end, with the mounting block of a circuit making terminal electrode of the coupling component; a further object being to electrically connect the grounding strip with the conductor receiving ferrule associated with the mounting block of the grounded terminal electrode.

Another important object of the invention is to provide a multiple circuit plug and socket connector in which the plug carries a plurality of flat, prong forming terminal electrode blades, at least one of which lies in a plane normal to that of an adjacent blade; a further object being to dispose a plurality of the blades of a coupling plug side by side in a common plane, and to mount another blade of the plug in a plane intersecting said common plane; still another object of the invention is to dispose a pair of

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prong blades in parallel, spaced apart planes and another of the plug blades in a plane intersecting said parallel planes; yet another object of the invention is to dispose three flat plug blades in side by side parallel relation in a common plane, while disposing a fourth blade in a plane parallel and spaced on one side of said common plane, a fifth blade being mounted at the opposite side of and in position spaced from said common plane, said fifth blade lying in a plane normal to the said common plane, the cooperating socket component of the connector being formed with flat blade receiving terminal electrode elements disposed in position to matingly receive the so relatively spaced blade-like prongs of the plug component.

Briefly stated, in accordance with one aspect of the invention, a plug and socket connector may be provided wherein the cooperating connector components each comprise a base of insulating material formed with cylindrical cavities adapted to loosely receive therein cylindrical terminal electrode carrying blocks, each formed with an axial pocket opening at an end thereof and adapted to snugly receive a conductor enclosing ferrule therein. The ferrule may thus extend in position to be clampingly secured in said pocket by means of a set screw threaded in the block, thereby mechanically and electrically connecting a conductor with the block. Such set screw may extend at its outer end in a straight duct opening at its opposite ends in the pocket and at the peripheral surface of the mounting block, whereby the set screw may serve to rockably support a mounting plug in its cavity, and may be tightened and loosened in the block, as by means of a set screw driving tool inserted into the duct through the outwardly opening end thereof.

The mounting blocks of the plug and socket components may respectively carry contact making prongs and prong engaging clips or terminal electrodes thereon at the ends of said blocks remote from the conductor receiving pockets, whereby said prongs and clips, respectively, may be rockably supported upon the insulating bases of the coupling components, as by means of set screws, in position extending outwardly of said mounting blocks. The socket component may also comprise a clip enclosing housing of insulating material adapted to be mounted on the insulating base of the socket component, such housing being formed with cavities for snugly receiving and enclosing the several prong engaging clips, the clip enclosing housing being formed with slots giving access to the clip receiving cavities and through which the prongs may enter for engagement with the clip elements.

An open ended metal shell forming a housing may be provided for each of the components. The component mounting shells may have open ends formed for telescopic interfitment so that the components mounted therein may be brought into coupled relationship and, when in coupled relationship, will be entirely enclosed by the housing formed by the telescopically interfitted shells. Each shell may be formed, internally, with inwardly extending component mounting lugs, and fastening screws may be provided for clampingly securing the insulating base of the plug components and the base and clip enclosing housing elements of the socket component upon the mounting lugs of the corresponding component housing shells, the insulating bases of the components being formed each with a grounding conductor comprising a strip of electrical conducting material connected at one end, as with the conductor receiving ferrule of the component, the opposite end of the grounding strip extending in position to connect with one of the component mounting lugs when the component is mounted in assembled position in its enclosing shell.

The foregoing and numerous other important objects, advantages, and inherent functions of the invention will become apparent as the same is more fully understood

from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment of the invention.

Referring to the drawings:

FIG. 1 is a perspective view of a plug and socket connector embodying the present invention;

FIG. 2 is an enlarged sectional view taken substantially along the line 2—2 in FIG. 1;

FIG. 3 is a sectional view taken substantially along the line 3—3 in FIG. 2;

FIG. 4 is a perspective view of the plug component of the connector;

FIG. 5 is a sectional view taken substantially along the line 5—5 in FIG. 4;

FIG. 6 is a perspective view of a prong blade forming a component part of the plug component;

FIG. 7 is an enlarged sectional view taken substantially along the line 7—7 in FIG. 5;

FIG. 8 is a perspective view of the socket component of the coupling;

FIG. 9 is an enlarged sectional view taken substantially along the line 9—9 in FIG. 8;

FIG. 10 is a perspective view of a ground connection strip for electrically connecting a terminal electrode of the plug component as well as of the socket component, each with the component enclosing shell;

FIG. 11 is a plan view of the rear or bottom side of the insulating base of the plug component shown in FIG. 4; and

FIG. 12 is a plan view of the rear or bottom side of the insulating base of the socket component shown in FIG. 8.

To illustrate the invention the drawings show an electrical connector 13, comprising a pair of relatively separable plug and socket assemblies 15 and 17 adapted to be mechanically and electrically secured upon the terminal ends of multiple conductor cables 18 required to be electrically interconnected.

As shown, the assemblies 15 and 17 each comprise an electrical coupling component C and a housing component H in which the coupling component is firmly mounted and enclosed, the coupling components C of the assemblies 15 and 17 respectively forming plug and socket components P_c and S_c comprising base members 19_p, 19_s of suitable electrical insulation, such as Cymel, the same comprising a resinous material with glass fiber as a filler, and terminal electrodes forming electrical contact making elements 21_p, 21_s mounted upon the insulating bases of the components in position such that each terminal electrode of one component will engage and electrically connect with a corresponding electrode of the other, when the components are brought into interfitting coupled relationship.

To this end, the electrodes of both components are respectively mounted or formed on and electrically connected with mounting blocks 23_p, 23_s of identical sectional configuration and size, the same preferably comprising cylindrical bodies of metal, such as copper or other preferred electrical conducting material. These mounting blocks are sized for loose or wobbly interfitment in correspondingly shaped cavities 25_p, 25_s formed in the insulating bases 19_p, 19_s of the plug and socket components. Since the base 19_p of the plug component is somewhat thicker than the base 19_s of the socket component, the electrode mounting blocks 23_p and the block receiving cavities 25_p of the plug component are correspondingly longer than the electrode mounting blocks 23_s and the block receiving cavities 25_s of the socket component.

The terminal electrodes 21_p of the plug component may conveniently comprise metal blades, as of copper or other preferred electrical conducting material, each formed integrally upon or otherwise secured electrically and mechanically upon a mounting block 23_p, in position extending outwardly of an end thereof, in a plane diametrically inter-

secting the same, as shown more particularly in FIG. 6 of the drawings. The terminal electrodes 21_s of the socket component may comprise each a strip of metal, as of copper or other preferred electrical conducting material, bent to form a clip having a medial base portion 27 adapted to be electrically and mechanically secured to an end of a mounting block 23_s, as by means of a rivet 28 formed on the block in position to penetrate a perforation in said base portion 27. Each terminal electrode clip may also comprise a pair of mutually inwardly inclined side portions 29 integrally connected to the opposite ends of the base portion 27, the ends of said side portions 29, remote from the base portion, being bent mutually inwardly through an angle of the order of one hundred eighty degrees to provide a pair of substantially parallel, mutually facing blade engaging portions 30 spaced apart a distance slightly less than the thickness of the blades of the terminal electrodes 21_p, whereby a cooperating pair of said blade engaging portions, by virtue of the resilience of the side portions 29, may yieldingly press upon and electrically connect with the opposed sides of a blade disposed therebetween.

The mounting blocks 23_p and 23_s may be formed each with an axial pocket 31 opening at the end of the block remote from the block mounted terminal electrode, the pocket being sized to slidably receive a cylindrical ferrule 32. The ferrule, in turn, is sized to snugly receive the bared end of a conductor 33 forming a component of the cable 18. In order to mechanically and electrically connect the end of the cable in the ferrule and the ferrule in the pocket 31 of a mounting block, the latter may be formed with a radially extending, internally threaded hole 34 sized to threadingly receive a clamping set screw 35. By inserting the end of the conductor 33 in the ferrule 32, then applying the conductor mounted ferrule in the pocket 31 of a mounting block and tightening the set screw 35 in the hole 34, the ferrule may be clamped to the block and upon the conductor to thereby electrically connect the conductor with the block.

The set screw 35 also may be employed to anchor the block in the base member of its associated coupling component. To this end, the set screw may be formed with an extended outer end adapted to project radially outwardly of the mounting block, when in conductor clamping position; and the insulating base member in which the block is to be secured may be formed with a channel 36 extending radially of the block receiving cavity and opening at one end into the cavity in position to interfittingly receive the outer end of the set screw in the cavity connected end of the channel. The other end of the channel may open at the periphery of the insulating base. Each of the block receiving cavities of each base 19_p, 19_s may thus have a corresponding connected channel 36 through which a set screw may be applied into the threaded hole 34, after insertion of the block in its cavity 31. The channels also serve to accommodate a set screw driving tool to facilitate the application of a set screw in the hole 34.

The coupling shown in the drawings embodies a centrally disposed prong blade 21_p in the plug component surrounded by four equally spaced blades, the socket component having a corresponding arrangement of the blade receiving clips 21_s. The blade mounting blocks 23_p are also anchored in the insulating base in position to orient the central blade 21_p and two others in position extending in a common plane diametrically of the coupling. The remaining pair of blades is mounted in position, on opposite sides of said common plane and extending, respectively, in planes parallel and normal to the common plane. The foregoing arrangement provides visual means aiding in mutually orienting the components into position to be coupled, as well as making it impossible to couple the components in any relatively turned position other than that providing proper polarity or phase relation of the connected con-

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ductors. In this connection, the specific arrangement of blades disposed in a common plane, in conjunction with parallel and normal blades on opposite sides of the common plane, makes it infinitely easier to couple the components than where blades are disposed in patternless fashion for polarizing purposes.

The socket component Sc, if desired, may include a cover 37 for enclosing the clips comprising the electrode terminals 21s. This cover may be formed of electrical insulating material, such as that of which the bases 19p and 19s are formed. At one end, the cover 37 may be formed to engage the front face of the base 19s around the projecting electrode terminals 21s, the cover being formed with cavities 38 for receiving each a corresponding one of the terminals 21s. Access slots 39 also are formed in the base remote end of the cover opposite the terminals and connected each with a corresponding one of the cavities 38, so that the blades forming the electrodes 21p, when applied through the access slots 39, may each pass between the blade engaging portions 30 of a corresponding terminal 21s and make electrical connection therewith.

The housing components H in which the coupling components C are mounted may each comprise an open ended metal shell 40p, 40s, as of cast aluminum or other suitable material. The shells are formed for sliding interfitment at their open ends, the other ends of the shells being necked in to form tubular cable entrance ways 41s and 41p for the accommodation of the ends of the cables 18 to be coupled. The tubular entrance ways may be internally tapered and externally threaded for the attachment of threaded glands or collars 42 for squeezing cable clamping sleeves 43 of rubber-like material, such as neoprene, in the tapered entrance ways and upon the cable ends therein. The housing shells 40p and 40s may be externally coated with a layer of rubber-like insulation 44, such as neoprene, if desired, and the shells may be formed with preferably integral, internally extending mounting lugs for receiving and supporting the plug and socket components therein.

As shown, each shell 40p, 40s is formed with a pair of diametrically opposite lugs 45 which have threaded openings for the reception of threaded clamp bolts 45p, 45s, and an intermediate lug 46 fitted with an orienting pin 46p disposed in position for reception in a pin receiving socket 46s formed in the insulating base of the associated coupling component, when the component is in mounted position on the lugs. The clamp bolts 45s may be employed to secure the cover 37 on the base 19s of the socket component, and to that end may extend in registering bolt channels formed in the cover and base, the bolts 45p extending in similar channels formed in the base 19p of the plug component. The heads of the bolts 45p and 45s, respectively, may be received in seats 47p and 47s formed in the base 19p of the plug component and in the top of the cover 37 of the socket component.

The grounded conductor of the cable is preferably always connected to the central terminal electrodes of the coupling components, and since it is desirable to ground the shells 40p and 40s, the conductor ferrule 32 of each component is electrically connected to one end of a grounding strip 48, the same comprising a strip of electrical conducting material, such as copper. The backs of the bases 19p and 19s of both components are formed with a depression to receive the strip 48, when the attached ferrule is in mounted position in the pocket 31 of the mounting block of the central terminal electrode. The strip when in mounted position on the base extends radially thereof, the ferrule remote end of the strip being disposed at the edge of the base in position to engage and electrically connect with a mounting lug 45 of the shell, thereby electrically connecting the shell with the grounded conductor of the cable connected with the coupling component. The outer end of the grounding strip

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48 may be formed with an opening 49 to accommodate a clamping bolt 45p, 45s.

The shell 40s may be formed with a hollow, outstanding flute 50 providing an internal channel 51. The channel may enclose a bent leaf spring 52 secured at one end to the flute by means of a rivet 53. The free end of the spring is bent and normally presses inwardly upon a stud 54 secured upon the housing shell in position to ride in the channel 51 when the shells are axially moved together or apart. The spring applies a yielding force on the stud tending to hold the components together in relatively coupled condition, and requiring appreciable force to disconnect the same, so that in separating the components the connection between the blades 21p and clips 21s is broken sharply and rapidly.

It is thought that the invention and its numerous attendant advantages will be fully understood from the foregoing description, and it is obvious that numerous changes may be made in the form, construction and arrangement of the several parts without departing from the spirit or scope of the invention, or sacrificing any of its attendant advantages, the form herein disclosed being a preferred embodiment for the purpose of illustrating the invention.

The invention is hereby claimed as follows:

In a plug and socket connector, a coupling component comprising an insulating base having opposed faces and formed with an electrode mounting cavity provided with an open end extending at one face of the base and a bottom connected with the opposite face of the base through a conductor port, an electrode carrying block sized for loose interfitment in the cavity and carrying a contact making electrode at one end of the block in position extending outwardly of the base at the open end of the cavity, said block being formed with an axial pocket opening at its opposite end in registration with said port, a ferrule adapted to be removably mounted in the pocket in position to receive the end of an electrical conductor extending through said port, a set screw mounted in the block and having an inner end adapted to extend in said pocket in position to clampingly squeeze the ferrule in the pocket and upon the end of the conductor, said set screw having an outer end projecting in position for loose interfitting engagement in a radial seat formed in the base and opening upon the side of the cavity, a shell forming a housing for said component and having an integral lug disposed in position providing a component seat, a fastening bolt threaded in said lug for clampingly securing the base of the component thereon, and a grounding strip electrically connected with said ferrule at the open end of said pocket and extending in position to be clamped against said lug by said base, said strip being secured to said ferrule and extending in position overlying a face of said base between the ferrule and the lug.

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