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U. TUCHEL

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COUPLINGS FOR ELECTRIC CONDUCTORS

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FIG. 2

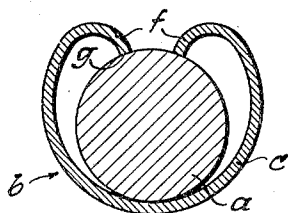


FIG. 3

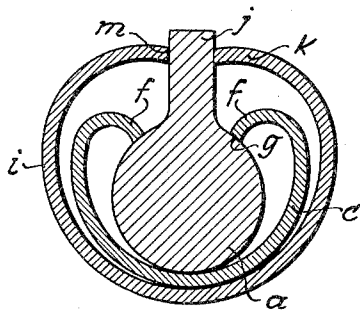
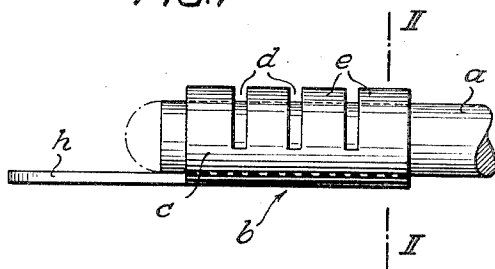


FIG. 1



INVENTOR  
ULRICH TUCHEL  
BY *Leon M. Straus*  
AST.

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## COUPLINGS FOR ELECTRIC CONDUCTORS

Ulrich Tuchel, Heilbronn (Neckar), Germany

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This invention relates to electric connections or couplings of the plug and socket type.

It is an object of the present invention to provide means affording novel and greatly improved electric couplings or connections wherein resistance to current flow between prongs and socket sleeves is reduced to a minimum.

It is another object of the present invention to provide means facilitating tight gripping of prongs in socket sleeves of electric couplings as well as self-cleaning of the contact surfaces of such prongs and socket sleeves to keep same free of dirt and other interfering substances.

It is still another object of the present invention to provide means conducive to simplified, yet highly efficient socket members for electric couplings, which sockets are adaptable for use with prongs of a variety of cross-sectional shapes.

A further object of the present invention is to provide means ensuring extremely effective, easily and inexpensively manufactured electric couplings which may be used for long periods of time without showing any signs of deterioration or giving rise to undue power losses.

In general, it is well known to construct electric couplings in which at least one blade-like prong or pin is so inserted into a longitudinally slitted tube or sleeve having a generally circular or oval cross-section that the edges of the sleeve defined by the slit grip the prong in the manner of teeth or tongs. Apart from a high contact pressure, it is possible, in such a construction, to attain a cleaning of the various terminals by providing the sleeve with a plurality of incisions in a direction transverse to the direction of insertion of the prong into the sleeve. These incisions give rise to a plurality of resilient teeth, the front edges or surfaces of which contact the prong and enable dirt and oxide layers to be scraped therefrom. Such constructions have been suitable heretofore only for blade-like prongs or so-called flat prongs.

In arrangements employing circular prongs, a slitted socket sleeve may be combined with a rigid prong or a slitted prong with a rigid sleeve or tube. The main object of these latter constructions, however, has been only to obtain a sufficient contact pressure but never a self-cleaning effect between prong and sleeve. Such cleaning is, of course, not attainable in the absence of scraping edges on the prong and sleeve. It has already been proposed, therefore, to construct the socket sleeve for circular prongs of sheet metal bent into a suitable form. However, such known construction gives rise only to a point contact in which self-cleaning of the terminals of the above described types can never occur.

The main purpose of the present invention is, consequently, to so adapt heretofore known plug and socket couplings, which have tooth-like resilient contacts adapted to cooperate with blade-like prongs, that the tooth-like contacts can cooperate with any desired type or formation of prong. This result is attained according to the invention by bending inwardly free, adjacent edges of the socket sleeve defining the aforesaid slit in such a manner

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that these edges make surface contact with and simultaneously press a prong inserted into the sleeve against the opposite inner wall of said sleeve.

Whereas in known constructions of plug and socket connections having longitudinally slitted resilient contacts the blade-like prong is inserted between the edges of the slit, according to the invention a circular prong is inserted into the internal space or cavity of a longitudinally slitted sleeve and is not only gripped by tooth-like ends of the sleeve but is also pressed against the internal wall of said sleeve. This leads to an electric contact between the prong and the sleeve over a greater surface area in conjunction with a self-cleaning effect, which, therefore, can now be obtained even when round prongs are employed together with resilient, tooth-like socket sleeves. Accordingly, the formation of such tooth-like, resilient socket sleeves becomes extraordinarily simple, while the cooperating rigid prong may be given any desired shape whatsoever.

Furthermore, a modification of the heretofore known tooth-like contacts has been employed in the past, consisting of the provision of a plurality of resilient socket contacts or terminals having geometrically similar shapes, which contacts, when arranged internally of one another, provide a plurality of mutually independent contact surfaces. This is, of course, possible with the structure of the invention. According to the invention, the arrangement can be so predetermined that the rigid prong may be key-shaped in cross-section, whereby the internally arranged resilient teeth contact the shaft of the key and the external resilient teeth the blade-like bit of the key.

In any event, such a construction results in high contact pressure and low electrical resistance together with a self-cleaning of the terminals, even if one of them be a round prong. Such cleaning is essential in order to maintain resistance to current flow as well as terminal heating at a minimum.

These and other objects of the invention will become further apparent from the following detailed description, reference being made to the accompanying drawing, showing preferred embodiments of the invention.

In the drawing:

Fig. 1 is a side view of a prong and socket sleeve connection of an electric coupling embodying the invention; Fig. 2 is an enlarged sectional view of the structure of Fig. 1 taken along the line II—II; and

Fig. 3 is a sectional view of a further embodiment of the invention taken along a line substantially in the same position as line II—II in Fig. 1.

Referring more particularly to Figs. 1 and 2, it will be seen that the coupling according to the invention includes a prong *a* inserted into a socket sleeve *b*, which sleeve consists of a longitudinally slitted resilient tube *c* provided with a plurality of incisions or cut-out portions *d* extending transversely of the direction of insertion of prong *a* and across the slit. In this embodiment, therefore, there are provided eight independently working resilient teeth *e*, as is already known. At its front end prong *a* may be provided with a rounded surface or a sharpened edge, as illustrated in dotted lines in Fig. 1, in order to facilitate its insertion into the socket sleeve. As can be seen from Fig. 1, the socket sleeve is substantially heart-shaped in cross-section.

According to the invention, the free ends *f* of teeth *e* which grip prong *a* are bent inwardly so that they contact the prong with their front edges or surfaces *g*, which were formed by the longitudinal slitting of tube *c*, and press the prong against the inner surface of the socket sleeve. As the prong is inserted into sleeve *b*, the end edges of the latter as well as front surfaces *g* of teeth *e* scrape any dirt or oxide particles present from the surface of the prong. This self-cleaning effect be-

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comes noticeable even after only a limited period of use. As is well understood, socket sleeve *b* is provided with an extension *h* to which a wire or conductor may be connected.

Similarly to the known expedient of providing flat prongs with a plurality of resilient, tooth-like socket contacts, it is possible to place a plurality of geometrically similar longitudinally slitted tubes *c* one into another so that their apices are in electric contact with one another. This may be accomplished by soldering, riveting, or welding them together. If each tube *c* is provided with three transverse incisions *d*, then the assembly as a whole will, of course, have twenty-four independently working resilient teeth *e*, these, naturally, presenting a like number of front edges or surfaces *g*.

Referring now to the embodiment illustrated in Fig. 3, there is provided, by way of example, a socket member having two longitudinally slitted tubes *c* and *i*, one of which is located internally of the other. The prong in this case is key-shaped in cross-section, thus presenting a shaft *a* which is substantially circular in cross-section and a blade-like bit *j*. The key-like structure of the prong is very appropriate because of its adaptability to a socket sleeve regardless of the cross-section of the latter, and because of the greater mechanical strength imparted to thereby to that part of the prong which is subject to the greatest amount of use.

Inner socket sleeve *c* is constructed in the same manner as that shown in Fig. 2, i. e., it is provided with inwardly bent ends or lugs *f*, which contact shaft *a* of the prong with their front edges *g*. The free ends *k* of the outer longitudinally slitted tube *i* are not bent inwardly but slide with their front edges *m* against the blade-like prong part *j*. Naturally, both sleeves *c* and *i* are provided, besides the longitudinal slit, with a plurality of transverse incisions *d* in a manner similar to that illustrated in Fig. 1.

The embodiment of Fig. 3 can be further modified by providing a plurality of concentric sleeves *c* and a plurality of concentric sleeves *i*, the teeth of the former sliding on shaft *a* and the teeth of the latter on blade-like part *j*. That it has become possible, according to the invention, to employ the illustrated tooth-like resilient contacts in conjunction with a prong having a key-shaped cross-section is, understandably, a special advantage of the invention.

Thus it can be seen that according to the invention there has been provided a plug and socket connection affording a high contact pressure with only slight resilience of the socket sleeve, and large contact surface area in a minimum of space. The resistance to current flow is at a minimum and is maintained at such level by the self-cleaning operation of the terminals. The coupling according to the invention can be employed for weak as well as high power currents such as are found in electric light or high voltage sockets. In the latter case, the extension *h* (see Fig. 1) may take the form of a suitable clamping device to which an electric conductor can be connected.

The novel plug and socket connection is also utilizable in high-frequency arrangements such as television sets. Other applications for the coupling according to the invention are, for example, vacuum tubes such as are used in radio sets, cathode ray tubes, electric light bulbs and fixtures therefor, neon or similar lamps, electric heating devices, etc.

The self-cleaning effect of the connection according to the invention can be enhanced by providing the surface of the prong, whether it be circular or key-shaped in cross-section, with a series of small grooves (not shown) so as to roughen said surface. These may be formed, for example, by filing the surface very lightly. As a result, there are produced on the surface of prong *a* (or *a*, *j*, as the case may be), a series of minute ridges which rub against the contact surfaces *g* or *g*, *m*, respectively,

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to clean the same. If these fine grooves are furthermore oriented at a small angle to the direction of motion of the prong in the socket, then dust and oxide particles will not only be scraped off but also removed from the path of contact, so that under no condition could a current interrupting film or layer be formed or maintained.

The drawing, of course, illustrates the invention only schematically and only to the extent necessary for an understanding of the invention.

Various changes and modifications may be made without departing from the spirit and scope of the present invention and it is intended that such obvious changes and modifications be embraced by the annexed claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent, is:

1. In an electric coupling of the plug and socket type; a prong of substantially circular cross-section, a tubular socket sleeve for receiving said prong and having a longitudinal slit in its wall forming spaced edges, said socket sleeve being resilient and provided with a plurality of partially circumferential cut-out portions oriented transversely to the direction of and intersecting said slit and forming a plurality of resilient teeth terminating in said spaced substantially flat-surfaced edges, said teeth being bent inwardly of said socket sleeve and in surface contact with said prong, whereby the contact surface of said prong is scraped clean by said teeth as said prong is being inserted into said socket sleeve and said prong, when located within said socket sleeve, is pressed by said teeth against the inner surface of said socket sleeve.

2. In an electric coupling of the plug and socket type; a prong of substantially key-shaped cross-section and constituted by a substantially circular shaft portion and substantially flat bit portion, a socket member including a first tubular socket sleeve having a longitudinal slit in its wall forming first spaced substantially flat-surfaced edges, and a second tubular socket sleeve having a longitudinal slit in its wall forming second spaced substantially flat-surfaced edges, both said sleeves being provided with a plurality of partially circumferential cut-out portions intersecting the respective slits and oriented substantially transversely to said slits and forming a plurality of resilient teeth one each of said sleeves terminating in said spaced edges, said first sleeve being located within said second sleeve and having its apex fixed to the apex of said second sleeve, said teeth of said first sleeve being bent inwardly of said first sleeve, whereby said teeth of said first sleeve are in surface contact with said shaft portion and press the same against the internal surface of said first sleeve, and said teeth of said second sleeve are in surface contact with said bit portion when said prong is located within said socket member.

3. An electric coupling for electrical conductors; comprising prong means and socket means, said socket means comprising resilient sleeve means provided with at least one longitudinal slit defined by substantially flat-surfaced adjacent edges, said prong means being adapted to be inserted into the space within said sleeve means, said sleeve means having an internal surface and being provided with a plurality of longitudinally spaced, transverse incisions, said incisions intersecting with said slit to thereby form a plurality of oppositely located resilient teeth terminating in said edges, at least some of said teeth being constructed for surface contact with said prong means and to press said prong means through said edges against said internal surface of said sleeve means when said prong means is inserted into said sleeve means, whereby intimate electric contact over a maximum surface area is achieved.

4. A coupling according to claim 3, said sleeve means comprising at least one sleeve, and said teeth on said one sleeve being bent inwardly to press said prong means, when inserted into said sleeve, against the internal surface of the latter substantially diametrically opposite said slit.

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5. A coupling according to claim 3, said prong means being key-shaped in cross-section and presenting a shaft-like portion and a bit-like portion, said sleeve means including at least two sleeves, one of which is located within the other, said sleeves contacting one another adjacent their apices and having their respective slits aligned with each other, the inner one of said sleeves having the teeth thereon bent inwardly to contact said shaft-like portion and press the same against the internal surface of said inner sleeve, and the outer one of said sleeves having its respective teeth in sliding contact with said bit-like portion.

6. A coupling according to claim 3, said prong means being provided with a plurality of minute ridges and grooves in its surface oriented angularly with respect to the direction of insertion of said prong means, whereby said teeth scrape interfering particles from the surface of said prong means during insertion of the latter which particles are led out of the electric contact area by said angular ridges and grooves.

7. In an electric coupling, a socket member comprising a socket sleeve provided with a longitudinal slit in its wall forming spaced edges, said edges each being divided into a plurality of resilient teeth, and said teeth being bent inwardly of said sleeve.

8. In an electric coupling; a socket member comprising an outer sleeve provided with a longitudinal slit in its wall forming spaced edges facing one another, and an inner sleeve located within said outer sleeve and provided with a longitudinal slit in its wall forming spaced edges, said slits being aligned with one another and said sleeves being affixed to each other adjacent their apices, said edges of both said sleeves each being divided into a plurality of resilient teeth, said teeth of said inner sleeve being bent inwardly of said inner sleeve.

9. An electric coupling for electric conductors; comprising prong means, socket means including sleeve means for said prong means, and deformed means forming part of said sleeve means and arranged in surface contact with said prong means, said deformed means extending in transverse direction to the longitudinal axis of said sleeve means and therewithin, whereby the contact-effecting surfaces of said deformed means are positioned closer to

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said longitudinal axis than the remainder of said sleeve means.

10. An electric coupling for electric conductors; comprising prong means, socket means including sleeve means for said prong means, and deformed means in surface contact with said prong means, said deformed means being separated from each other and integral with said sleeve means and extending in transverse direction to the longitudinal axis of said sleeve means and therewithin, whereby the contact-effecting surface of said deformed means are positioned closer to said longitudinal axis than the remainder of said sleeve means.

11. An electric coupling for electric conductors according to claim 9, wherein said deformed means constituting part of said sleeve means are severed from each other and bent to impart a configuration substantially heart-shaped in cross-section to the inner surface defining said sleeve means so as to obtain tight fit between said prong means and said inner surface of said sleeve means upon insertion of said prong means thereinto.

12. An electric coupling for electric conductors; comprising elongated prong means, socket means including sleeve means for said prong means, said socket means being provided with a plurality of resilient teeth having end surfaces, said end surfaces contacting said prong means on opposite sides of a central plane of said prong means passing through the longitudinal axis of the latter, and at least some of said teeth exerting a resilient force on said prong means to press the same against the opposite inner surface of said sleeve means for contact therewith in the vicinity of said central plane, whereby electric contact between said prong means and said sleeve means over a maximum surface area is established in at least three spaced locations.

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