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ELECTRICAL CONNECTOR

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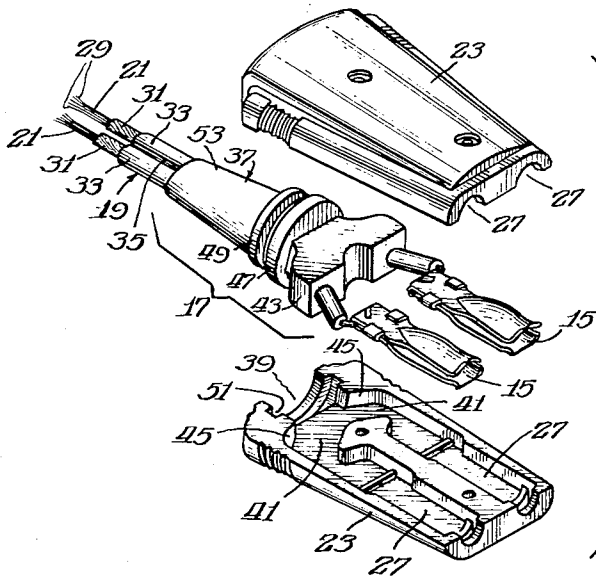
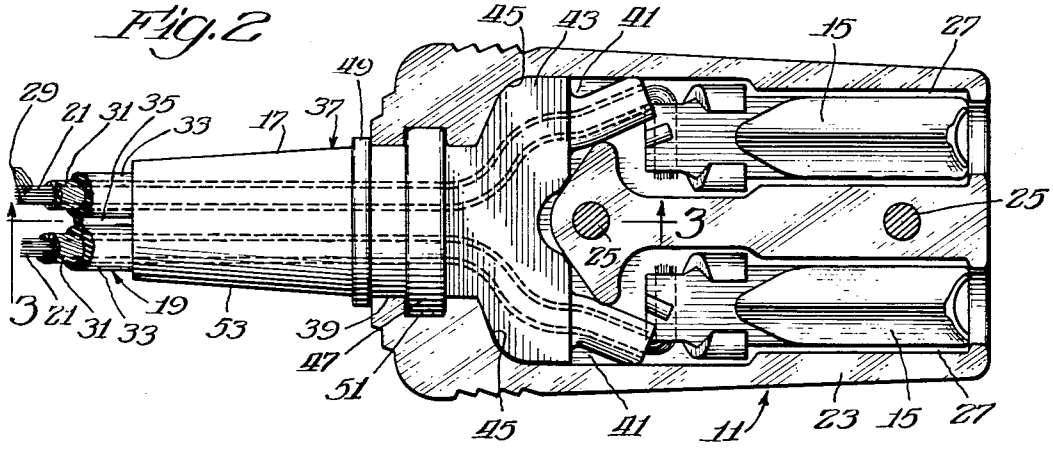


Fig. 1

Fig. 2



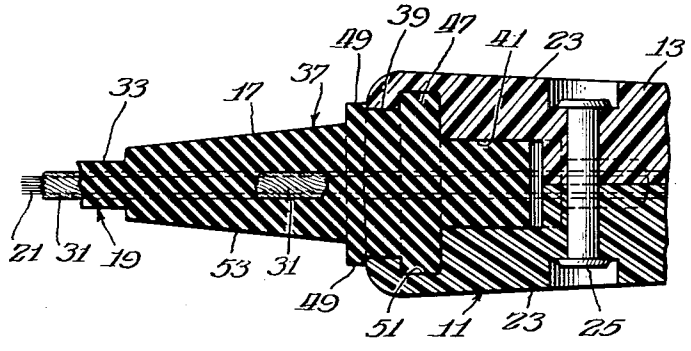


Fig. 3

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ELECTRICAL CONNECTOR

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The present invention relates to electrical connectors, and more particularly to detachable plug connectors, of the type used for connecting electrical conductor cords to electrically heated appliances, such as toasters, flat irons, coffee makers, and the like.

Connectors of this general type usually include a hollow, elongated shell or body of rigid, heat-resistant insulating material having two socket-type contacts supported in side-by-side relationship within two, open-ended recesses formed in the connector body. The connector body usually comprises two cooperating half-sections. The individual conductors of the conductor cord with which the connector is used are suitably attached to the socket-type contacts within the insulating body.

During use of the conductor cords and connectors of this type, it is very common practice for the user to effect the disengagement of the connector from the appliance with which it is used by jerking or pulling the conductor cord. This practice is dangerous, especially when regularly followed because it almost always results in injury to the cord or to the internal electrical connections and sometimes even to the user. However, the appliance is frequently hot, and it is difficult to convince users not to jerk or pull the cord. As a result, it has been found highly desirable to provide connectors of this type with a strain-relief means which shall be effective to transmit tensional stresses applied to the cord directly to the connector body, thereby relieving the electrical connections from strain.

The conductor cord is also subject during use to considerable bending stress at the point at which it enters the connector body. Sharp bending of the conductor cord at this point may lead to eventual breakage of the internal connections with consequent electrical failure. It is therefore desirable to provide connectors with a cord guard which eliminates or minimizes the bending stress on the conductor cord adjacent the connector body.

Various arrangements are in use and others have been proposed for eliminating or relieving the tensional and bending stresses on the conductor cord, but none is completely satisfactory. Generally, such relief means is provided by the attachment of metallic springs or bars to and/or around the conductor cord to reinforce or provide a guard for the conductor cord and to provide a locking engagement between the conductor cord and the connector body. Such metallic means have been known to wear through the insulation of the conductor cord and eventually come into contact with the inner conductors of the cord. When this occurs, an electrical hazard develops which could injure the user. In addition, the means of attachment of such metallic devices to the conductor cord generally creates a strain upon the cord insulation and reduces the thickness of the insulation at the point of attachment. Still another difficulty which may arise with a metallic-type cord guard is that it is possible for moisture to create a conductive path from one of the contacts within the connector body to the metallic cord guard and thence to the exterior of the connector body. The principal objects of the invention, therefore, are to provide an electrical connector of the class described which shall have an improved strain-relief and cord guard; to provide a connector which shall be more efficient and more reliable in operation than those previously known; and to provide a connector which shall be simple in form, inexpensive to manufacture, and easy to assemble.

Still another disadvantage in the prior art connectors of the type described is that the contacts within such connectors become extremely hot and this extreme heat is transmitted for a considerable distance along the conductor cord. The transmission of high temperatures to the cord exteriorly of the connector makes the connector inconvenient to grasp and since the external cord is subject to considerable bending stresses, the combination of such bending stresses and excessive heat may weaken and eventually destroy the cord insulation. Another object of the invention, therefore, is to provide a connector which shall confine the heat produced primarily within the connector body.

The means whereby the above objects are attained, and other objects and advantages of the invention will be made apparent in the accompanying drawings and following description of one illustrative embodiment of the invention.

In the drawings:

Figure 1 is an exploded perspective view of an electrical connector formed in accordance with the present invention;

Figure 2 is an enlarged plan view of the electrical connector, one section of the connector body being removed to show the interior arrangement; and

Figure 3 is a partial sectional view of the assembled electrical connector taken along the lines 3—3 of Figure 2.

The electrical connector **11** illustrated in the drawings includes a rigid outer body **13** of heat-resisting material, a pair of socket-type spring contacts **15** which lie in side-by-side relation within the body **13** of the connector, and an end section **17** of a conductor cord **19**. The end section **17** of the conductor cord **19** extends partially within the rigid body **13** of the connector and is formed in a particular manner in accordance with the present invention as will be hereinafter set forth. The conductor cord **19** includes a pair of conductors **21** which connect with the spring contacts **15**.

The outer body **13** of the connector comprises two rigid, generally rectangularly-shaped, cooperating half sections **23**, which are adapted to be securely held together in face-to-face relation, when the connector is assembled, by a pair of rivet fastenings **25**, or equivalent means. The opposed faces of the two cooperating half sections **23** of the connector body are hollowed out so as to define in the assembled connector two similar, generally parallel, elongated recesses **27** for receiving the two, socket-type spring contacts **15**. The spring contacts **15** are adapted to cooperate with contact pins or the like (not shown), forming a part of the appliance with which the connector is used. The contacts **15** are of conventional type and the recesses **27** are so formed that the contacts are securely held against any substantial longitudinal movement relative to the outer body **13** when the connector is in assembled condition. The recesses **27** are, of course, open at the outer end to admit cooperating contact pins or the like.

Any of the usual duplex or two-conductor type cords which are provided with a heat-resistant rubber-type outer covering or insulation may be used in conjunction with the present connector. In the conductor cord **19** illustrated in the drawings, each of the conductors **21** is pref-

erably formed from a plurality of metallic strands 29 and is surrounded by a sheath of heavy cotton serving 31 and an outer flexible, insulating jacket 33 formed from a heat-resistant rubber such as neoprene or butyl rubber. The outer jackets 33 which surround the two conductors 21 are integrally joined along their lengths by a narrow bridge 35 formed from the same insulating material as that which forms the outer jackets 33 so as to maintain the conductors 21 in substantially parallel, spaced relation. The bridge 35 of insulating material forms the weakest portion of the conductor cord 19 and can be broken when separation of the individual conductors 21 is desired.

The individual insulated conductors of the conductor cord 19 extend through the length of the end section 17. At a point intermediate the length of the end section, the individual conductors 21 diverge from the spacing that they maintain along the main length of the conductor cord 19 to a spacing approximately equal to the spacing between the elongated contact-receiving recesses 27 in the conductor body 13 and extend to the end of the section 17 at this wider spacing. The extreme ends of the individual conductors 21 are free of insulation and connected to the spring contacts 15. The end section 17 includes a shaped mass of heat-resistant, flexible insulating material 37 which surrounds and is integrally bonded to a portion of the insulated conductors to form a cord guard and strain-relief for the connector. The shaped mass of insulating material 37 extends from a point along the conductor cord 19 spaced inwardly from the point of divergence of the insulated conductors to a point outwardly from the point of divergence of the insulated conductors and adjacent the ends of the insulated conductors.

The shaped mass of insulating material 37 is preferably formed about the insulated conductors by means such as molding from a material which is similar to that which forms the outer insulating jackets 33 of the conductors 21. However, it should be understood that the shaped mass of insulating material 37 may be formed from any suitable flexible, heat-resistant material which forms a permanent bond with the outer insulating jackets 33 surrounding the conductors 21, and in certain cases, it may be formed of varying composition with the portion adjacent the end of the conductor cord 19 of a composition which is more heat-resistant than the portion which is somewhat further removed from the end of the conductor cord 19.

The end of the conductor cord 19 including the forward portion of the shaped mass of insulating material 37 is positioned within the interior of the connector body 13 when the connector is in assembled condition. The connector body 13 includes an enlarged cylindrical cord-receiving passageway 39 which connects with the contact-receiving recesses 27 through branch passageways 41 which extend at substantially right angles to the cord-receiving passageway 39 and the contact-receiving recesses 27. The outer portion 43 of the mass of insulating material 37 is suitably shaped so as to snugly fit within the cord-receiving passageway 39 and the upper portion of the branch passageways 41. The spaced insulated conductors extend outwardly from the end of the shaped mass of insulating material 37 and into each of the contact-receiving recesses where the conductor ends are firmly connected to the inner ends of the spring contacts 15.

Since the branch passageways 41 extend at right angles from the cord-receiving passageway 39, they provide outer shoulder sections 45 which engage portions of the mass of insulating material 37 to prevent withdrawal of the conductors 21 from the assembled connector. Tensional stresses applied to the conductor cord 19 will be transmitted to the body 13 of the connector through the mass of insulating material 37, thereby eliminating strain and possible injury to the electrical connections between the conductors 21 and spring contacts 15. To further position and anchor the outer portion 43 of the mass of insulating material 37 within the connector body 13, the portion 43 is preferably provided with spaced-apart annular collars 47 and 49. The collars 47 and 49 are suitably located and dimensioned so that the collar 47 is adapted to seat within an annular recess 51 formed as an enlargement of the cord-receiving passageway 39 intermediate the ends thereof, and the collar 49 is adapted to abut the external face of the connector body 13 adjacent the cord-receiving passageway 39. The collar 47 provides a further interengagement between the connector body 13 and the mass of insulating material 37 for transmitting tensional strains to the body of the connector. In addition, the collars 47 and 49 help to secure the end section 17 from movement relative to the connector body; and the collar 49 helps to seal the end of the cord-receiving passageway 39 against the entrance of moisture, etc.

In addition to its strain relief function, the mass of insulating material 37 within the body 13 of the connector prevents the heat which is generated at the contacts 15 during use of the connector from overheating the conductor cord externally of the connector. Since the mass of insulating material 37 within the connector is fairly large and engages the connector body over quite a large area, the heat generated at the contacts 15 is mainly dissipated within the mass of insulating material 37 and connector body 13 so that the conductor cord 19 exteriorly of the connector is maintained at a reasonable temperature.

In order to minimize bending and kinking of the connector cord 19 adjacent the connector body 13, the mass of insulating material 37 desirably extends from the connector body 13 for a short distance beyond the collar 49. The mass of insulating material 37 decreases in diameter in a direction outwardly from the connector body 13 so as to form a tapering portion 53 which provides the conductor cord with a section of progressively increasing flexibility in a direction outwardly from the connector body 13.

When constructing the connector, the shaped mass of insulating material 37 may be formed either before or after the ends of the conductor 21 are attached to the contacts 15. The end portion of the conductor cord together with the attached contacts are first suitably positioned in one of the sections 23 of the connector body and the other section 23 of the connector body 13 is then appropriately positioned thereover. The rivets 25 are then applied to lock the assemblage in position.

The above construction, while being very simple in design, inexpensive to manufacture, and easy to assemble, has proven highly efficient. Further, in contrast with many known arrangements, this construction does not lose its strain-resisting ability after the connector has been in use for some time. In addition, the described construction increases the effective lifetime of the associated conductor cord to an extent not previously attainable because of its ability to eliminate or minimize tensional stresses on the connections, bending stresses on the conductor cord, and excessive heating of the conductor cord.

We claim:

1. An electrical connector of the class described comprising, a pair of generally flat, cooperating half sections of heat-resistant inflexible insulating material assembled in face-to-face contact to provide the outer body of the connector, said half sections having opposed recesses which provide a pair of spaced-apart contact-receiving recesses, a centrally disposed conductor cord-receiving passageway, and transversely extending branch passageways which connect said contact-receiving recesses and said cord-receiving passageway, contact members occupying said contact-receiving recesses, a conductor cord having a pair of insulated conductors extending into the interior of said connector body through said cord-receiving passageway, the outer insulation surrounding said conductors being of heat-resistant, flexible material, said insulated conductors of said conductor cord branching at

the lower end of said cord-receiving passageway with one of said insulated conductors extending through one of said branch passageways and the other of said insulated conductors extending through the other of said branch passageways, each of said conductors having a bared end portion which is connected to one of said contact members, said insulated conductors being embedded within an enlarged mass of heat-resistant, flexible insulating material within the region of said cord-receiving passageway and said branch passageways, the insulation surrounding said conductors being integrally joined with and forming part of said enlarged mass of insulating material, and said enlarged mass of insulating material having approximately the same dimensions as said cord-receiving and branch passageways so that the major portion of the surface of said mass of insulating material engages the surfaces of said cord-receiving and said branch passageways.

2. An electrical connector of the class described comprising, a pair of generally flat, cooperating half sections of heat-resistant inflexible insulating material assembled in face-to-face contact to provide the outer body of the connector, said half sections having opposed recesses which provide a pair of spaced-apart contact-receiving recesses, a centrally disposed conductor cord-receiving passageway, and transversely extending branch passageways which connect said contact-receiving recesses and said cord-receiving passageway, contact members occupying said contact-receiving recesses, a conductor cord having a pair of insulated conductors extending into the interior of said connector body through said cord-receiving passageway, the outer insulation surrounding said conductors being of heat-resistant, flexible material, said insulated conductors of said conductor cord branching at the lower end of said cord-receiving passageway with one of said insulated conductors extending through one of said branch passageways and the other of said insulated conductors extending through the other of said branch passageways, each of said conductors having a bared end portion which is connected to one of said contact members, said insulated conductors being embedded within an enlarged mass of heat-resistant, flexible insulating material from a point along said conductor spaced from said connector body to a point within said connector body adjacent said contact-receiving recesses, the insulation surrounding said conductors being integrally joined with, and forming part of, said enlarged mass of insulating material, within said connector body being located within, and having approximately the same dimensions as, said cord-receiving and branch passageways so that the major portion of the surface of said enlarged mass of insulating material within said connector body engages the surfaces of said cord-receiving and branch passageways, and the portion of said enlarged mass of insulating material which is external of said connector body tapering in a direction outwardly of said connector body to provide the conductor cord with a section of progressively increasing flexibility in a direction outwardly of the connector body.

3. An electrical connector of the class described comprising, a pair of generally flat, cooperating half sections of heat-resistant inflexible insulating material assembled in face-to-face contact to provide the outer body of the connector, said half sections having opposed recesses which provide a pair of spaced-apart contact-receiving recesses, a centrally disposed cord-receiving passageway, and transversely extending branch passageways which connect said contact-receiving recesses with said cord-receiving passageway, contact members occupying said contact-receiving recesses, a conductor cord having a pair of insulated conductors extending into the interior of said connector body through said cord-receiving passageway, the outer insulation surrounding said conductors being of a heat-resistant elastomer, said insulated conductors of said conductor cord branching at the lower end of said cord-receiving passageway with one of said insulated conductors extending through one of said branch passageways and the other of said insulated conductors extending through the other of said branch passageways, each of said conductors having a bared end portion which is connected to one of said contact members, said insulated conductors being embedded within an enlarged mass of a heat-resistant elastomer from a point along said conductor cord spaced from said connector body to a point within said connector adjacent said contact-receiving recesses, the elastomer surrounding said conductors being integrally joined with, and forming a part of, said enlarged mass of elastomer, the portion of said enlarged mass of elastomer within said connector body being located within the region of, and having approximately the same dimensions as, said cord-receiving and branch passageways so that a major portion of the surface of said mass of elastomer within said connector body engages the surfaces of said cord-receiving and branch passageways, the portion of said enlarged mass of elastomer within said connector body including a collar which is located within an annular recess forming an enlargement of said cord-receiving passageway, the portion of said enlarged mass of elastomer which is external of said connector body tapering in a direction outwardly of said connector body to provide the conductor cord with a section of progressively increasing flexibility in a direction outwardly of the connector body, and said enlarged mass of elastomer including a collar which abuts the external face of said connector body adjacent said cord-receiving passageway.

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