March 30, 1954 C. I. SMITH 2,673,968

SELF-PIERCING ELECTRICAL CONNECTOR PLUG

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Fig. 1.

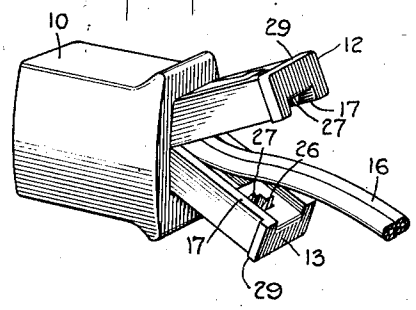


Fig. 2.

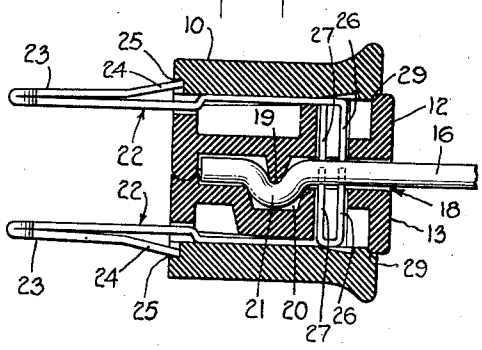


Fig. 3.

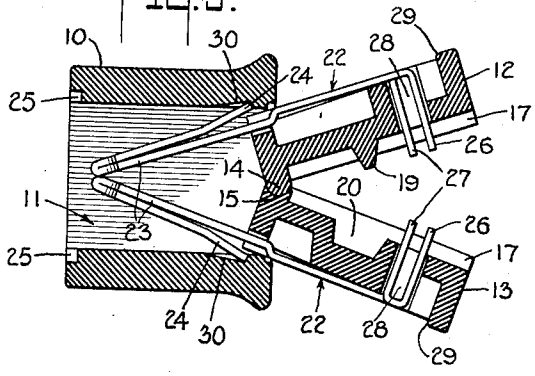


Fig. 4.

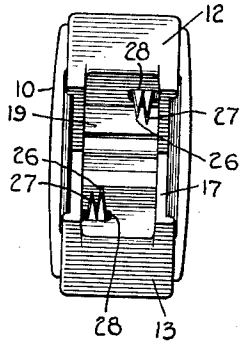
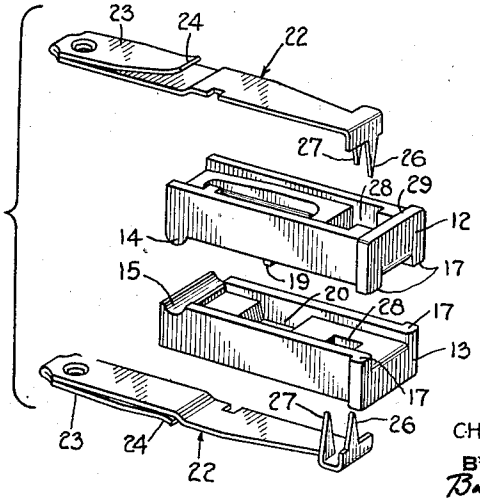


Fig. 5.



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SELF-PIERCING ELECTRICAL CONNECTOR PLUG

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17 Claims. (Cl. 339—99)

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The present invention relates to an electrical connector plug and relates more particularly to an electrical connector plug of the self-piercing type.

An object of the present invention is to provide an electrical connector plug that does not require the user to strip the insulation from the wires of a conductor cord in order to connect the wires to the contact elements of the plug thus making it possible for unskilled persons to attach the plug to a conductor cord quickly without the use of tools. Another object of the invention is to provide a connector plug of the self-piercing type in which the various parts of the plug cannot accidentally become separated and live contacts cannot be exposed while the plug is in use. A further object of the invention is to provide a connector plug of the self-piercing type that is suitable for use with various sizes of conductor cords.

Other objects and advantages of the invention will be apparent and best understood from the following description and the accompanying drawings in which:

Fig. 1 is a perspective view of an electrical connector plug embodying the invention showing the parts of the plug in position to receive a conductor cord;

Fig. 2 is a side view in section of the connector plug illustrated in Fig. 1 showing the parts of the plug with the conductor cord installed;

Fig. 3 is a side view in section of the connector plug as illustrated in Fig. 1;

Fig. 4 is an end view taken from the rear of the connector plug illustrated in Fig. 3; and

Fig. 5 is an exploded view in perspective of the contact elements and conductor cord gripping jaws of the connector plug illustrated in Fig. 1.

Referring now to the drawings in detail, there is an outer body or housing 10 of insulating material that is shaped so that it may be conveniently grasped by the user for inserting and withdrawing the plug from an electrical outlet. The body or housing 10 is hollow and is open at its front and back ends with a passageway 11 extending lengthwise through it.

Slidably fitted within the passageway 11 of the outer shell are two jaw-like members 12 and 13 of insulating material. The jaws 12 and 13 are hinged or pivoted on each other at their forward ends which are normally located inside of the housing 10. In the illustrated embodiment, the hinging or pivioting of the jaws 12 and 13 is accomplished by providing mating sections at the forward ends of the respective jaws. The

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mating section on the jaw 12 is in the form of a projecting bead 14 that fits into a mating groove 15 in the other jaw 13. Thus, when the jaws 12 and 13 are moved to the rear of the housing 10, the pivotal movement of the jaws permits them to open or separate at their rear ends, as illustrated in Fig. 3, to receive the end of a conductor cord 16 between them.

The opposing faces of the jaws 12 and 13 have abutting flanges 17 along their sides which space the portions of opposing faces between the flanges from each other to form a passageway 18 between the jaws that is shaped to receive and position the end of the conductor cord 16. A tooth 19 projects from the face of the jaw 12 and intermeshes with a cavity 20 in the face of the other jaw 13 when the jaws are closed. When the conductor cord has been inserted between the jaws, the tooth 19 engages with the conductor cord 16 and forces it into the cavity 20 forming a U-shaped bend 21 in the conductor cord at this point, as shown in Fig. 2. The U-shaped bend 21 in the conductor cord 16 is clamped between the tooth 19 and the sides of the cavity 20 and provides a strain relief that will prevent stripping of the conductor cord from the plug by pulling on the cord alone.

The jaws 12 and 13 each carry a contact element 22. The contact elements 22 are each made from a single strip of electrically conductive material that is folded back on itself at one end to form a connector prong 23 that is shaped to fit into an electrical outlet and is double the thickness of the strip. The rearwardly extending end of the folded portion is flared outwardly to provide a resilient projection 24 at the base of the prong that engages with one of a pair of recesses 25 in the front end of the housing 10 when the jaws are fully inserted in the housing. The inner leg of the prong 23 is offset so that the resilient projection 24 may be moved out of engagement with the front end of the housing by pressing the projections inwardly.

The other end of the strip forming the contact 22 is bent to form two conductor piercing prongs or blades 26 and 27 that project from one face of the strip. The ends of the conductor piercing prongs are pointed and the points of the respective prongs 26 and 27 are spaced transversely from each other, as shown best in Fig. 4, to insure that one of the prongs will contact with the wire in one side of the conductor cord 16 upon piercing the conductor cord regardless of whether a small or large diameter conductor cord is used. The prong 26 is formed by bending the end of the

contact element 22 at right angles and the prong 27 is formed by bending a portion of the strip that has been severed along the side of the contact 22 at right angles. As shown best in Fig. 3, the conductor piercing prongs 26 and 27 are U-shaped when viewed from the side, but the points of the prongs are offset laterally and transversely from each other. The conductor piercing prongs 26 and 27 on the respective contact elements 22 project through openings 28 in the jaws 12 and 13 and extend at least halfway across the conductor receiving passageway 18 between the jaws on opposite sides of the passageway in order to penetrate the insulation and make contact with the wire in the respective sides of the conductor cord 16 when the jaws are closed.

In attaching the plug to a conductor cord, the resilient ends 24 of the prongs 23 are pressed inwardly to disengage them from the recesses 25 in the front end of the housing and then the contact elements 22 and the jaws 12 and 13 are pushed rearwardly through the housing 10. When the jaws 12 and 13 project beyond the rear end of the housing, they are resiliently opened by the spring pressure exerted by the resilient ends 24 of the connector prongs against the inner walls of the housing 10. The end of the conductor cord is then inserted as far as possible between the open jaws, as illustrated in Fig. 1, and the jaws are then pushed forward into the housing 10 until shoulders 29 on the rear ends of the jaws 12 and 13 engage with the rear end of the housing 10. The forward movement of the jaws closes the jaws and forces the conductor piercing prongs through the insulation and into contact with the wires of the conductor cord. It also brings the tooth 19 into engagement with the conductor cord forming the bend 21 in the conductor cord 16 with the cord thus being clamped and held between the jaws independently of the conductor piercing prongs.

When the jaws 12 and 13 have been fully moved forward relative to the housing 10, the resilient ends 24 of the connector prongs 23 spring outwardly and engage with recesses 25 in the front end of the housing 10 and prevent the contact carrying jaws from accidentally being moved relative to the housing so that live contacts cannot be exposed while the plug is in use. The ends 24 of the connector prongs 23 also engage with notches 30 in the walls of the passageway 11 when the contact elements 22 and the jaws 12 and 13 have been moved to the rear of the housing. This prevents the complete removal of the jaws 12 and 13 from the housing 10 as a result of their rearward movement.

As will be seen from the foregoing, the attachment of a connector plug embodying the invention to a conductor cord is extremely simple and can be made without the use of tools of any sort. In addition, after the plug has been attached, it is safe as no live contacts can become exposed through accidental displacement of its parts. The plug also permits the use of different sizes of conductor wires such as are in common use. It will also be noted that the housing 10 and the jaws 12 and 13 may be readily molded from suitable materials and that the contact elements 22 may be made from a single strip of material. Thus, a connector plug embodying the invention can be made at a minimum cost.

It will be understood that various changes and modifications may be made in the illustrated embodiment of the invention without departing from the scope of the invention as defined by the following claims.

I claim:

1. In an electrical connector plug of the self-piercing type, the combination of an outer housing of insulating material, said housing being hollow and having openings at its ends, a pair of jaw-like members having their forward ends slidably fitted within said housing, said jaw-like members pivotally engaging with each other at their forward ends with their opposed faces being recessed at the rear ends thereof to form a passageway shaped to receive a conductor cord and a contact element carried by each of the jaw-like members, each of said contact elements having a conductor piercing prong at one end thereof and a connector prong at the other end thereof, said conductor piercing prongs extending into opposite sides of the conductor receiving passageway and said connector prongs extending beyond the forward ends of the jaw-like members and the front end of the housing.

2. In an electrical connector plug of the self-piercing type, the combination as defined in claim 1 wherein the connector prongs of the contact elements have resilient portions at their bases that extend outwardly therefrom and engage with one end of the housing and the rear ends of the jaw-like members engage with the other end of the housing.

3. In an electrical connector plug of the self-piercing type, the combination of a hollow housing of insulating material, said housing having openings at its front and rear ends, a pair of contact carrying jaws slidably fitted within the housing, said jaws pivotally engaging with each other at their forward ends with portions of their opposing faces being spaced apart at the rear ends thereof to form a passageway shaped to receive the end of a conductor cord, clamping means carried on the opposed faces of said jaws, said clamping means engaging with and clamping the conductor cord between the jaws, a contact element carried on the outside of each of the contact-carrying jaws between said jaws and the housing, said contact elements each consisting of a strip of electrically conductive material having a conductor piercing prong at one end thereof and a connector prong at the other end thereof, said conductor piercing prongs extending through the respective jaws and into the conductor receiving passageway, said connector prongs extending beyond the forward ends of the jaws and the front end of the housing, and yieldable projections carried by said connector prongs, said projections being located at the base of each connector prong and engaging with the front end of the housing.

4. In an electrical connector plug of the self-piercing type, the combination as defined in claim 3 wherein the clamping means consists of a tooth projecting from the face of one of the jaws with the other of said jaws having a cavity in its opposing face into which said tooth extends.

5. In an electrical connector plug of the self-piercing type, the combination of a hollow housing of insulating material, said housing having openings at its front and rear ends, a pair of contact carrying jaws having their forward ends slidably fitted within the housing and their rear ends engaging with the rear end of the housing, said jaws being pivotally joined together at their forward ends with their opposing faces being spaced apart at the rear ends

thereof to form a passageway shaped to receive the end of a conductor cord, and contact elements carried by each of the jaws, a conductor piercing prong carried at one end of each of the contact elements, the conductor piercing prongs of the respective contact elements having pointed ends projecting into the passageway between the opposed faces of the jaws on opposite sides thereof, said contact elements being folded at their other end to form connector prongs, said connector prongs extending beyond the forward ends of the jaws and the front end of the housing, the inner legs of said connector prongs being offset inwardly and the rearwardly extending ends of the outer legs of said connector prongs projecting outwardly at the base of said prongs, said outwardly projecting portions being resilient and engaging with the front end of the housing when the contact elements and the jaws are inserted within the housing, said housing having notches on the inner surface thereof adjacent the rear end of the housing, said notches being positioned to engage with the outwardly projecting ends of the connector prongs upon rearward movement of the contact elements and the jaws.

6. In an electrical conductor plug of the self-piercing type, the combination as defined in claim 5 which includes intermeshing portions on the opposing faces of the contact carrying jaws, said intermeshing portions engaging with the clamping of the conductor cord between the jaws independently of the contact elements.

7. In an electrical connector plug of the self-piercing type, the combination of a hollow housing of insulating material, said housing having an opening extending therethrough from the front to the rear thereof and notches in the inner surfaces thereof, a pair of contact-carrying jaws slidably fitted within the opening in the housing, said jaws pivotally engaging with each other at their forward ends with portions of their opposed faces at their rear ends being spaced apart to form a passageway shaped to receive the end of a conductor cord, a contact element carried by each of said jaws, said contact elements each consisting of a strip of electrically conductive material having a conductor piercing prong at one end thereof and a connector prong at the other end thereof, said conductor piercing prongs extending through the jaw carrying said contacts into the conductor receiving passageway on opposite sides thereof, said connector prongs extending beyond the forward ends of the jaws and the front end of the housing and yieldable projections carried by the connector prongs, said projections extending outwardly from the prongs at the bases thereof and engaging with the front end of the housing when the jaws are inserted in the opening in the housing and with the notches in the inner surfaces of the housing when the jaws are moved to the rear of the housing.

8. In an electrical connector plug of the self-piercing type, the combination of a hollow housing of insulating material, said housing having an opening extending therethrough from the front and the rear thereof and notches in the inner surfaces thereof, said notches being located at the rear of the housing, a pair of contact-carrying jaws slidably fitted within the housing, said jaws pivotally engaging with each other at their forward ends with portions of their opposing faces being spaced apart at the rear ends thereof to form a passageway shaped to receive

the end of a conductor cord, clamping means carried on the opposed faces of said jaws, said clamping means engaging with and clamping the conductor cord between the jaws, a contact element carried by each of said jaws, said contact elements each consisting of a strip of electrically conductive material having a conductor piercing prong at one end thereof and a connector prong at the other end thereof, said conductor piercing prongs extending through the respective jaws and into the conductor receiving pasageway, said connector prongs extending beyond the forward ends of the jaws and the front end of the housing, and yieldable projections carried by said connector prongs, said projections being located at the base of each connector prong and engaging with the front end of the housing when the jaws are inserted in the opening in the housing and with the notches in the inner surface of the housing upon movement of the jaws to the rear of the housing.

9. In an electrical connector plug of the self-piercing type, the combination of a housing of insulating material, said housing having an opening extending therethrough, a pair of opposed contact supporting members of insulating material slidably fitted within the opening in the housing, said members being pivoted on each other at their forward ends and being swingable toward and away from each other upon movement into and out of the housing, the opposing faces of said members being recessed and defining a passageway to receive the unstripped end of a conductor cord, said passageway being open at the rear of said members, clamping means on the opposing faces of said contact supporting members engaging with and holding the end of a conductor cord in said passageway, and a contact element carried by each of said members, each of said contact elements including a connector prong at one end thereof and a conductor piercing prong at the other end thereof, the connector prongs extending beyond the forward ends of the contact supporting members and the housing when the contact supporting members are inserted in the housing, the conductor piercing prongs on the respective contact elements extending into the conductor receiving passageway on opposite sides of the center line thereof.

10. In an electrical connector plug of the self-piercing type, the combination of a housing of insulating material, said housing having an opening extending therethrough, a pair of opposed contact supporting members of insulating material slidably fitted within the opening in the housing, said members being pivoted on each other at their forward ends, the opposing faces of said members being recessed and defining a passageway to receive the unstripped and unseparated end of a twin conductor cord, said passageway being open at the rear of said members, a contact element carried by each of said members, each of said contact elements including a connector prong at one end thereof and a conductor piercing prong at the other end thereof, the connector prongs extending beyond the forward ends of the contact supporting members, the conductor piercing prongs on the respective contact elements extending into the conductor receiving passageway on opposite sides of the center line thereof and clamping means carried by said members, for clamping the end of the conductor cord in said passageway, said clamping means and the conductor piercing prongs being movable into and out of engagement with

the conductor cord upon movement of the contact carrying members into and out of the housing.

11. In an electrical connector plug of the self-piercing type, the combination of a housing of insulating material, said housing having an opening extending therethrough, a pair of opposed contact supporting members of insulating material slidably fitted within the opening in the housing, said members being pivoted on each other at their forward ends and being swingable toward and away from each other upon movement into and out of the housing, the opposing faces of said members being recessed and defining a passageway to receive the unstripped and unseparated end of a twin conductor cord, said passageway being open at the rear of said members and a contact element carried by each of said members, each of said contact members including a connector prong at one end thereof and a conductor piercing prong at the other end thereof, the connector prongs extending beyond the forward ends of the contact supporting members and the housing when the contact-supporting members are inserted in the housing, the conductor piercing prongs on the respective contact elements extending into the conductor receiving passageway on opposite sides of the center line thereof.

12. In an electrical conenctor plug of the self-piercing type, the combination of a hollow housing of insulating material, said housing having openings at its front and rear ends, a pair of opposing contact carrying jaws having their forward ends slidably fitted within the housing, said jaws pivotally engaging with each other at their forward ends with portions of their opposed faces being spaced apart at the rear ends thereof to form a passageway shaped to receive the end of a conductor cord, a contact element carried on the outside of each of the jaws, said contact elements being located between the respective contact-carrying jaws and the housing and each consisting of a strip of electrically conductive material having a pair of conductor piercing prongs at one end thereof and a connector prong at the other end thereof, said conductor piercing prongs extending through the respective jaws and projecting into the conductor receiving passageway on opposite sides of the center line thereof, each pair of conductor piercing prongs having points that are spaced transversely and lengthwise with respect to each other, said connector prongs extending beyond the forward ends of the jaws and having yieldable projections extending outwardly therefrom, said projections releasably engaging with the front end of the housing when the jaws are in a forward position in the housing and resiliently engaging with the inside of the housing when the jaws are moved rearwardly thereof, said projections engaging with the inside of the housing at a point beyond the pivoted ends of the jaws and urging the rear ends of the jaws apart upon engagement with the inside of the housing.

13. In an electrical connector plug of the self-piercing type, the combination of a housing of insulating material, said housing having an opening extending therethrough, a pair of opposed contact supporting members of insulating material slidably fitted within the opening in the housing, said members being pivoted on each other at their forward ends and having opposing faces swingable toward and away from each other upon movement into and out of the housing, the opposing faces of said members being recessed and defining a passageway to receive the unstripped end of a conductor cord, said passageway being open at the rear of said members and a contact element carried by each of said members, each of said contact elements including a connector prong at one end thereof extending beyond the forward ends of the respective contact supporting members, said connector prongs extending beyond the forward end of the housing when the contact supporting members are in a forward position in the housing and a pair of conductor piercing prongs located at the other end of each of the contact elements, the prongs on each of the contact elements being spaced laterally and transversely with respect to each other on the respective contact elements with the prongs on the respective contact elements extending into the conductor receiving passageway on opposie sides of the center line thereof.

14. In an electrical connector plug of the self-piercing type, the combination of a housing of insulating material, said housing having a front and a rear end with an opening extending between said ends, a pair of opposed contact supporting members of insulating material, each of said members having an inner and an outer face and a forward and a rear end, the forward ends of said members being pivoted on each other and slidably fitted within the housing with the rear ends thereof being movable toward and away from each other upon movement of the members into and out of the housing, the inner faces of said members opposing each other and being recessed to define a passageway to receive the unstripped end of a conductor cord between said members, said passageway being open at the rear of said members and a contact element carried on the outer face of each of said members, each of said contact elements consisting of a strip of conductive material having a connector prong at one end thereof, a conductor piercing prong extending into the conductor receiving passageway at the other end thereof and a resilient locking member extending outwardly from the connector prong, said connector prongs extending beyond the forward ends of the contact supporting members and beyond the front end of the housing with the resilient locking members releasably engaging with the front end of the housing when the contact supporting members are inserted in the housing, said resilient members engaging with the inside of the housing at a point beyond the pivoted ends of the contact supporting members and resiliently urging the rear ends of said members away from each other upon movement of said members rearwardly of the housing.

15. In an electrical connector plug of the self-piercing type, the combination as defined in claim 14 wherein each of the contact supporting members has an opening extending through said member from the outer to the inner face thereof and through which the conductor piercing prongs of the contact element supported thereon extends, the openings in the respective members being located on opposite sides of the center lines of said members.

16. In an electrical connector plug of the self-piercing type, the combination of a housing of insulating material having an opening therein, a pair of contact-carrying members slidably mounted in said opening, said members having

inner and outer faces with the outer faces thereof engaging with the sides of the opening in the housing and holding the inner faces thereof in opposing relation, said inner faces having recesses therein shaped to receive an unstripped end of a dual conductor cord between said members, each of said members having an opening extending therethrough at right angles to and communicating with one half of said recess and a contact element carried by each of said members, said contact elements consisting of a strip of electrically conductive material extending along the outer faces of and parallel to the recesses in said members, each of said strips including a connector element and having a conductor-piercing prong projecting from one face thereof, said conductor-piercing prong having a pointed end extending through the opening in one of the contact-carrying members to at least the top of the recess therein.

17. In an electrical connector plug of the self-piercing type, the combination as defined in claim

16 wherein each of the contact elements has a plurality of conductor piercing prongs and said prongs are spaced laterally and transversely with respect to each other on the contact elements.

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