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ELECTRICAL CONDUCTOR PLUG HAVING INSULATION SHEATH PENETRATING MEANS FOR CONTACTING CONDUCTORS

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Fig. 1

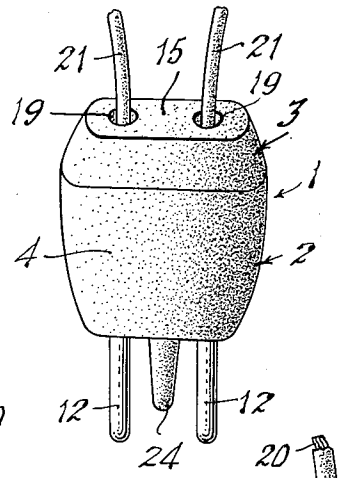


Fig. 2

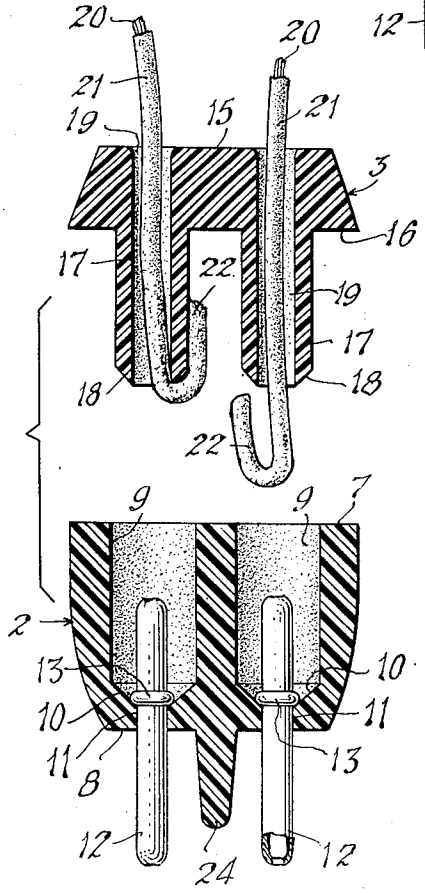


Fig. 3

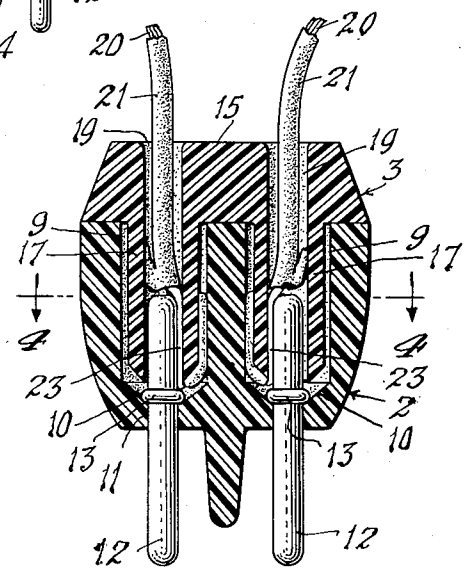
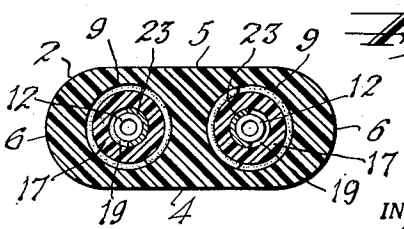


Fig. 4



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ELECTRICAL CONDUCTOR PLUG HAVING INSULATION SHEATH PENETRATING MEANS FOR CONTACTING CONDUCTORS

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5 Claims. (Cl. 339—99)

This invention relates to electrical connector plugs of the type including a body formed of a plurality of parts and having pins or prongs projecting therefrom to which wires are connected in the body and more particularly the invention contemplates such an electrical connector plug unit especially adapted for use with an electrically operated toy where simplicity and low cost are desired.

A primary object of the present invention is to provide such an electrical connector plug unit in which positive and secure mechanical and electrical connections between the component elements of the plug unit are automatically and simultaneously effected by the simple act of assembling the component elements of the plug unit.

Another object of the invention is to accomplish a full and complete electric tight connection between the conductor wires and the contact prongs without previously removing the insulation from the conductor wire ends and to produce such connection without cutting into or otherwise damaging or weakening the conductor wires.

A further object of the invention is to provide an electrical connector plug unit in which the necessity for screw means, spring means or other extraneous fastening means for attaching the conductor wires to the terminals is eliminated, so that the parts of the connector can be assembled easily, rapidly and by relatively unskilled operators.

It is further proposed to produce an electrical connector plug unit which is simple and rugged in construction and which can be manufactured and sold at a reasonable cost.

Other objects and advantages of the invention will be apparent from the description thereof to follow taken in conjunction with the accompanying drawing in which—

Figure 1 is a perspective view of a completely assembled electrical connector plug unit made in accordance with the present invention.

Figure 2 is an enlarged disassembled vertical sectional view through the center of the connector plug unit, one of the conductor wires being shown displaced.

Figure 3 is a vertical sectional view on the same scale of the connector plug unit completely assembled.

Figure 4 is a cross-sectional view taken on the plane of the line 4—4 of Figure 3.

Referring to the drawing in detail, a completely assembled electrical connector plug unit **1** made in accordance with the present invention and adapted to be connected to an outlet receptacle in an electrically actuated toy is illustrated in Figure 1. The plug unit comprises a solid main body portion **2** and a solid cap portion **3** seated thereon. The body and cap portions are preferably molded of synthetic plastic material but may be made of any other suitable insulating material. The body portion **2** is substantially rectangular is cross-section with flat front and rear side surfaces **4** and **5**, respectively, and curved end surfaces **6** as shown in Figure 4, a flat top **7** as shown in Figure 2 and a flat bottom **8** as shown in Figures 2 and 3. At both sides of its transverse center, round smooth-walled cavities **9** extend substantially the depth of the body portion **2**, opening outwardly through

the flat top **7** and being closed at the bottom ends. The cavities, each of which has a bottom wall **10** tapering downwardly and converging into a straight smooth-walled passage **11** extending through the bottom **8**, are preferably, though not necessarily, cylindrical.

In each cavity **9** and extending through the passage **11** there is a contact prong in the form of a tubular metal pin **12** open but rounded at both ends. Intermediate its ends, the pin is formed with an annular bead forming a shoulder **13** which seats on the bottom of the tapered wall **10** of the cavity holding the pin in upright position, with part of the pin disposed inside the cavity and part protruding below the bottom **8** as shown in Figure 2.

The cap portion **3** is shaped substantially the same as the body portion **2** with a flat top and bottom **15** and **16**, respectively, and outwardly flared front, rear and end surfaces that merge gracefully with the corresponding surfaces of the body portion **2** when the cap portion is seated on the body portion, thereby presenting a completely assembled plug unit that is symmetrical and graceful in appearance as shown in Figure 1. At each side of its transverse center, the cap portion **3** is formed with a longitudinally downwardly projecting lug or stud **17**, cylindrical in cross-section, said lugs being of a length substantially equal to the depth of the cavities **9** of the body portion **2** and having tapered ends **18**. A smooth-walled passage **19**, round in cross-section, extends through each lug **17** and through the cap portion **3**, opening outwardly of its top **15**.

In actual use, a flexible conductor formed of a twisted wire **20** in an insulating sleeve **21** of rubber or other suitable insulating material is threaded through each passage **19** of the cap portion, with its inner leading end projecting beyond the bottom end **18** of the lug **17**. The projecting leading end is then bent to form a hook portion **22** as shown most clearly at the top right side of Figure 2. The conductor is then pulled through the passage inwardly of the lug thereby drawing the hook portion **22** over the tapered end of the lug so that the wall of the lug is straddled or embraced by the hook portion. In this position, the extremity of the hook portion is disposed along the outer surface of the lug **17** and the bottom end of the conductor wire is positioned close to the inner surface of the passage **19** of the lug as shown at the top left side of Figure 2. The lugs **17** are next inserted into the cavities **9** of the body portion **2**. Each of the lugs with its conductor wire hooked over it is pushed inwardly of its respective cavity. The contact prong **12** in the cavity is in the path of such pushing movement so that the edge of the inner or top end of the prong engages the insulation **21** on the conductor wire initially at the hooked end of said wire and pierces or tears said insulation, and continued inward pushing movement and pressure against the prong will cause the prong to accommodate itself to the space provided in the passage **19** of the lug and in doing so strip the insulation off of the insulated conductor wire as indicated at **23**. At the same time, the wire and insulation are squeezed so that the bare wire is wedged and flattened out fanwise against the inner surface of the passage **19** in the lug thereby increasing the area of contact between the prong and the wire and forming a mechanical and electrical tight and firm connection between the contact prong and the bare portion of the conductor wire as shown in Figure 3. During this stripping and wedging action, the free end of the hook portion **22** of the conductor wire is squeezed and wedged between the outer surface of the lug and the adjacent inner surface of the cavity **9** in the body portion **2**. The inherent resiliency of the conductor wire and insulation permits it to yield during this squeezing and stripping action so that no damage or weakening of the wire takes place.

An "electric-tight" connection between the contact prong and the conductor wire is thus produced and the component elements of the plug unit are firmly connected together with a frictional wedge fit so that they cannot become accidentally separated.

The improved connector plug unit is especially adapted for use with an electrically actuated toy and to ensure that the plug unit is used or plugged into an outlet receptacle intended, the body portion **2** of the plug unit is formed with a tapered lug **24** depending from the bottom **8** thereof at its center. The plug unit will thus necessarily have to be used with an outlet receptacle especially equipped with a socket opening to receive such central lug **24** as well as the contact prongs **12**.

While I have illustrated and described the preferred embodiment of my invention, it will be understood that changes may be made in details of construction without departing from the principle of the invention and I desire therefore to be limited only by the state of the prior art and the appended claims.

Having thus described my invention, what I claim as new and desire to secure by United States Letters Patent is:

1. An electrical connector plug unit comprising an insulating body portion with spaced cavities extending and opening through one end thereof and with communicating passages extending through the other end of the body portion, contact prongs seated in said cavities, said prongs each having a portion extending into a cavity and a portion extending through the passage communicating with said cavity and outwardly of the body portion, an insulating cap portion seated on said body portion and having spaced projecting lugs in said cavities, said cap portion and lugs having passages there through, and conductor wires extending through said latter passages and having end portions hooked over the ends of the lugs, said wires having bare portions adjacent the hooked ends and tightly gripped between the walls of the corresponding said passages and the portions of the prongs extending into the cavities, the ends of said hooked end portions being wedged between the lugs in the cavities and the surfaces of the cavities of the body portion.

2. An electrical connector plug unit comprising an insulating body portion with spaced cavities extending and opening through one end thereof and with communicating passages extending through the other end of the body portion, contact prongs seated in said cavities, said prongs each consisting of an elongated tubular metal pin with a portion thereof extending into a cavity and with a portion thereof extending through the passage communicating with said cavity and outwardly of the body portion, a cap portion seated on said body portion and having spaced projecting lugs in said cavities, said cap portion and lug having passages therethrough, and insulated conductor wires extending through said latter passages, said wires having end portions hooked over the ends of the lugs, said wires having bare portions adjacent the hooked ends, said bare portions being wedged between the walls of the corresponding said passages and the portions of the prongs extending into the cavities, said hooked ends being wedged between the lugs in the cavities and the surfaces of the cavities of the body portion.

3. An electrical connector plug unit comprising a solid insulating body portion having prong receiving cavities and communicating passages, elongated contact prongs carried by said body portion, said prongs each having a portion seated in a cavity and a portion extending through and outwardly of the passage communicating with said

cavity, a cap portion having spaced elongated projecting rigid lugs, said cap portion and lugs having passages therethrough, insulated conductor wires in said latter passages having ends bent over the inner ends of the lugs, said prongs having cutting edges on the ends of the portions thereof seated in the cavities, said cutting edges being opposed to the bent over ends of the conductor wires so as to scrape the insulation away from the portions of the conductor wires adjoining the bent over ends when the lugs carrying the conductor wires are driven into the cavities, said portions of the prongs located in the cavities lying in mechanical and electrical engagement with the bare portions of the conductor wires.

4. An electrical connector plug unit comprising a solid insulating body portion having prong receiving cavities and communicating passages, elongated contact prongs carried by said body portion, said prongs each having a portion seated in a cavity and a portion extending through and outwardly of the passage communicating with said cavity, a cap portion having spaced elongated projecting rigid lugs, said cap portion and lugs having passages therethrough, said latter passages being circular in crossseetion, insulated conductor wires extending through said passages to one side of the center thereof, said wires having their inner ends bent over the inner ends of the lugs with the extremities thereof contacting the outer surfaces of the lugs at their bottom ends, said prongs having cutting edges on the ends of the portions thereof seated in the cavities, said cutting edges being opposed to the bent over ends of the conductor wires and being disposed in the path of movement of said conductor wires so as to scrape the insulation away from the portions of the conductor wires adjoining the bent over ends when the lugs carrying the conductor wires are driven into the cavities, said portions of the prongs located in the cavities lying in mechanical and electrical engagement with the bare portions of the conductor wires, said hooked ends being wedged between the lugs and the adjacent surfaces of the cavities.

5. An electrical connector plug unit comprising an insulating body portion with spaced cavities extending and opening through one end thereof and with communicating passages extending through the other end of the body portion, contact prongs seated in said cavities, said prongs each having a portion extending into a cavity and a portion extending through the passage communicating with said cavity and outwardly of the body portion, a cap portion of insulating material to seat on said body portion and having spaced lugs each slidable into one of said cavities, said cap portion and lugs having passages therethrough for conductor wires and to receive one of said prongs when said lugs are slid into said cavities, whereby conductor wires may be inserted through said passages, hooked over the ends of said lugs and wedge and tightly held between said lugs and the walls of the corresponding cavities and between said prongs and the walls of the corresponding said passages to firmly mechanically connect said body to said cap and said wires to said body and to electrically connect said wires to said prongs.

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