Nov. 8, 1960 E. JACOBSEN 2,959,766

ELECTRICAL CONNECTOR

Filed March 16, 1956

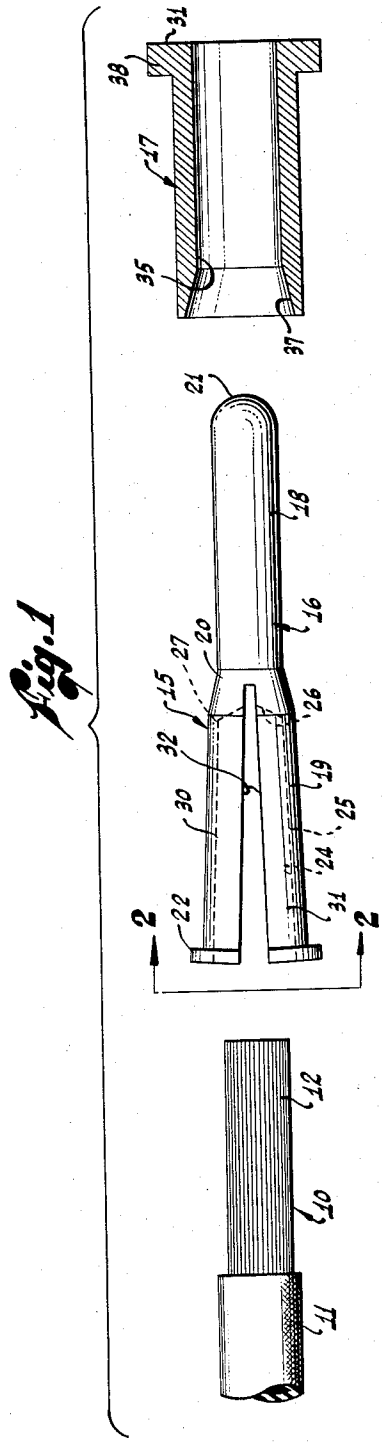


Fig. 1

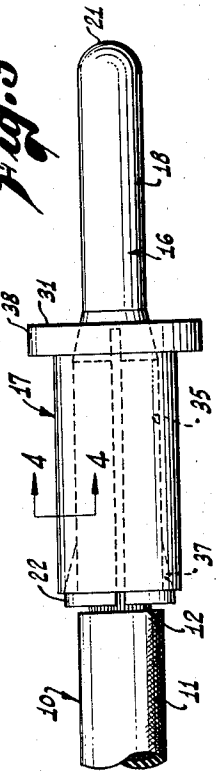


Fig. 3

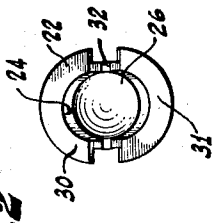


Fig. 2

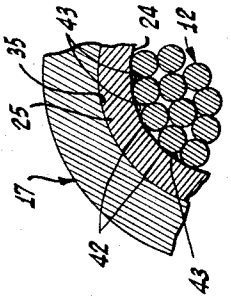


Fig. 4

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ELECTRICAL CONNECTOR

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1 Claim. (Cl. 339—273)

This invention relates to electrical connectors and more particularly to a plug or pin connector for connecting the end of a conductor into a socket. The electrical connector of this invention is especially advantageous when employed in radio work and particularly in aircraft.

It is an object of this invention to provide an improved electrical plug which may be effectively secured to an end of a conductor without the need for solder or screw fasteners and the like. The electrical plugs of this invention are adapted for use in installations where high temperatures develop in the electrical connections, and accordingly the use of conventional solders for securing a conductor into a plug is not feasible for this purpose.

Another object of the invention is to provide an electrical plug of the above mentioned character which clamps tightly around the end of a stranded cable conductor and in being so clamped has its contact surfaces deformed in a way such that the area of contact between the plug and the individual strands of the conductor is substantially increased, thereby to improve the electrical connection.

Another advantage resulting from the above mentioned deformation of the contact surface of the electrical plug of this invention is that the conductor becomes securely fastened in the plug, in a way comparable to molding a plug around a conductor, whereby the conductor may not be pulled out easily from the plug.

Further objects and advantages will appear in the following part of this specification, wherein the details of construction of a preferred embodiment of the invention are described with reference to the accompanying drawing, in which:

Fig. 1 is an exploded view of an electrical plug and a stranded cable to be inserted into the plug, the plug comprising a body shown in side elevation and a sleeve shown in longitudinal central section and in position to be received around the body for clamping the cable into the plug;

Fig. 2 is an end view of the plug body taken in the direction of the arrows 2—2 in Fig. 1;

Fig. 3 is a side elevation of the plug and cable in assembled position; and

Fig. 4 is a detail section, greatly magnified, of the contact surfaces of the plug and cable, taken on line 4—4 of Fig. 3.

Referring to the drawing in greater detail, and with the use of reference numerals, numeral **10** designates a conductor herein shown as a stranded wire cable of conventional construction. It has an insulation sheath **11**, the same being stripped off from an end portion **12** of the cable to expose the wires of the cable.

Reference numeral **15** designates, generally, an electrical plug in which the exposed end **12** of cable **10** is secured in a manner described more fully hereinafter. The plug comprises a body **16** and a sleeve **17**. The body comprises a cylindrical pin or head portion **18** and a cable receiving and clamping portion **19**, which in being formed is initially made cylindrical and of larger cross-sectional

area than the head portion **18**. These portions **18** and **19**, being disposed in axially aligned relationship, are integral with each other through a neck portion **20**. In the illustrated embodiment, the body **16** is circular in cross-section throughout its axial length; the neck portion **20** is of frustum configuration, and the head portion **18** is solid. That end of the head portion opposite the portion **19** is rounded as shown at **21** to provide for more easy insertion of the plug head into a plug-receiving socket (not shown). At the rear end of the body opposite end **21** there is an annular flange **22**, one side face of which is coplanar with the exposed end face of the portion **19**.

Extending inwardly from the flanged end of the body and coaxially in the portion **19** is a hole **24** defining a cylindrical wall **25** and an end wall **26**. This hole receives the exposed end portion **12** of the cable, and inasmuch as the illustrated cable **10** is circular in cross-section, the hole **24** is likewise circular in cross-section, thereby constituting a bore with its end wall **26** being conical. The apex of the conical end wall **26** is located within the neck portion of the body and the cylindrical wall of the bore preferably extends to a transverse plane, designated by reference numeral **27**, just short of the plane of the base of the frustum shaped neck portion.

In stripping off the insulation sheath from the cable **10** to expose the individual wires of the cable, the sheath is preferably stripped off to a distance such that the length of the exposed end **12** of the cable will be at least as great as the longitudinal dimension of the cylinder wall of the bore, in order that engagement of the cable and plug will be made throughout the full depth of the cylindrical wall of the bore.

The cross-sectional area of the bore **24** is slightly less than that of the exposed end of the cable and the importance of these relative sizes will be explained fully hereinafter.

The portion **19** of the body is divided longitudinally into two leg portions **30** and **31** by a narrow slot **32** which extends diametrically across the portion **19** and from the flanged end **22** to within the neck portion **20** beyond the apex of the conical end wall of the bore. These legs are then spread slightly apart to a position such as that shown in Figs. 1 and 2 of the drawing.

Referring now to the sleeve **17**, it is preferably at least as long as the body portion **19** and has a bore **35** extending therethrough, such bore having a diameter about equal to and preferably slightly less than that of the body portion **19**, whereby the sleeve will fit tightly over the body portion to a position at which annular end face **36** of the sleeve abuts against a side wall of the flange **22**. At end **36** the sleeve is beveled outwardly around the bore, as shown at **37**, and at the opposite end of the sleeve there is an annular flange **38** extending outwardly from the end of the sleeve to provide an end face **31** of increased area for accommodating a tool (not shown) suitable for pressing the sleeve over the body portion of the plug.

It is an important feature of this invention that the conductor-receiving portion **19** be so dimensioned with respect to the sleeve and with respect to the conductor and be formed of such composition that it will become appreciably deformed or altered, within limits hereinafter specified, in being clamped around the conductor by the sleeve. The diameter of the bore **25** is slightly smaller than that of the exposed end portion **12** of the conductor **10**. For the illustrated embodiment, in which the conductor constitutes a cable of stranded wires, the cylindrical wall **25** assumes a shape which generally mates with that of the outside surface of the cable, i.e., recesses **42** (see Fig. 4 of the drawing) are formed in the wall **25**

from pressure against respective wires disposed peripherally in the cable, while those portions of the wall **25** which span the space between adjacent wires of the cable become small flats as indicated at **43**.

The extent of deformation of the body portion **19** mentioned above and permitted according to this invention, is limited by the elastic limit or yield point of the particular metal selected for forming the plug body, such elastic limit or yield point being the smallest value of the stress which produces permanent deformation or alteration in the selected metal. I have found that the relative dimensions of the sleeve, the body portion **19**, and the conductor should be such that the stress developed in pressing the sleeve over the body portion containing an end of a conductor will fall within the range of 25% to 75% of the yield point of the metal of the body portion, and preferably be about 50% of such yield point. Thus the body portion **19** becomes non-permanently deformed by the inwardly exerted stress or tension of the sleeve **17** and the outward pressure of the conductor **10**.

Should the stress exerted in compressing or otherwise deforming the body portion **19** exceed the elastic limit of the metal from which the body is formed, and inasmuch as the use of relatively hard metals for this purpose is contemplated for this invention, such metal cracks and spalls and thereby fails to provide the optimum electrical connection obtained in practicing the invention, and does not secure the conductor tightly in the plug. In the case where the stress on the body portion is below the range specified above, there is insufficient elastic wedging of the body portion to grip the conductor tightly enough to provide the advantagese of this invention.

It is to be noted that the bevelled end **37** of the sleeve provides for relative axial movement of the sleeve over the body portion without permanent deformation of the outside surface of the body portion. Also, spreading apart of the leg portions **30** and **31** and the resulting inward movement thereof in being clamped around the conductor, improves the clamping and wedging action of the body portion.

The following sets forth the dimensions of a specific example of a pin connector embodying this invention and designed for use with a standard No. 10 stranded cable of copper wires, the body **16** and the sleeve **17** being formed of beryllium copper:

	Inches
Axial length of body **16**	1⅛
Length of portion **19** (including flange **22**)	½
Thickness of flange **22** (measured axially of body **16**)	1/32

	Inches
Axial length of neck **20**	3/32
Outside diameter of flange **22**	.218
Outside diameter of portion **19**	.173
Diameter of bore **24**	.113
Diameter of pin portion **18**	.125
Axial length of sleeve **17**	.531
Thickness of flange **38** (measured axially of the sleeve)	.062
Axial length of bevelled portion **37**	3/32
Greater diameter of bevelled portion **37**	.185
Diameter of bore **35**	.170
Outside diameter of sleeve	.220
Outside diameter of flange **37**	.350

While I have herein shown and described by invention in what I have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein, but is to be accorded the full scope of the claim so as to embrace any and all equivalent structures.

What I claim is:

In an electrical connector, a body having a cylindrical pin portion defining one end thereof, elongated clamping portions integral with said pin portion and extending longitudinally from an end thereof in diverging relation to each other, each of said clamping portions being of hollow semi-cylindrical form with their semi-cylindrical interiors facing each other, and a hollow cylindrical sleeve slidable over said clamping portions to force the same together to clamp a conductor therebetween, the radius of the inner surface of said sleeve being slightly less than the radii of the outer surfaces of said clamping portions, and the outer ends of said clamping portions being provided with laterally projecting stop means to limit sliding movement of said sleeve over said clamping portions.

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