United States Patent

Seim

[15] **3,656,088**

[45] **Apr. 11, 1972**

[54] CONNECTOR

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[73] Assignee: **Minnesota Mining and Manufacturing Company**, St. Paul, Minn.

[22] Filed: **July 27, 1970**

[21] Appl. No.: **58,248**

[52] **U.S. Cl.** **339/98**

[51] **Int. Cl.** **H01r 9/08**

[58] **Field of Search** 339/97–99

[56] **References Cited**

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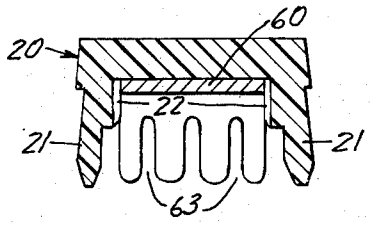
Attorney—Kinney, Alexander, Sell, Steldt & Delahunt

[57] **ABSTRACT**

Connector for small insulated aluminum wires comprises a wire-receiving insulating body member having wire-anchoring ridges and an insulating cap member carrying a resilient U-shaped connector plate which is doubly slotted, with a wide outer slot and a narrow inner slot, for each wire.

4 Claims, 6 Drawing Figures



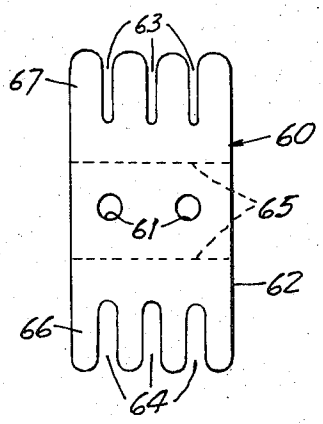


FIG. 1

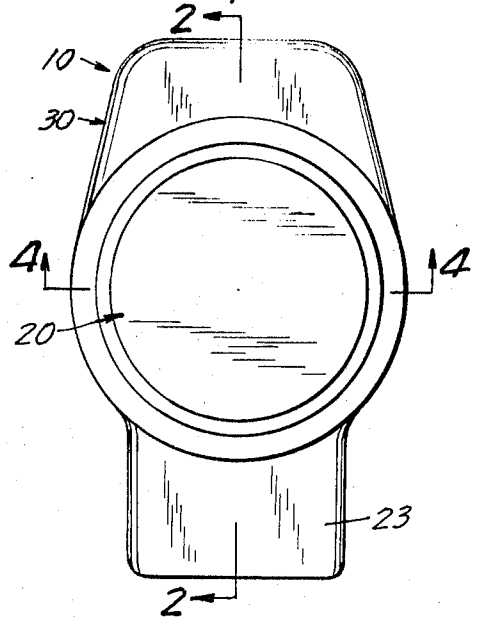


FIG. 3

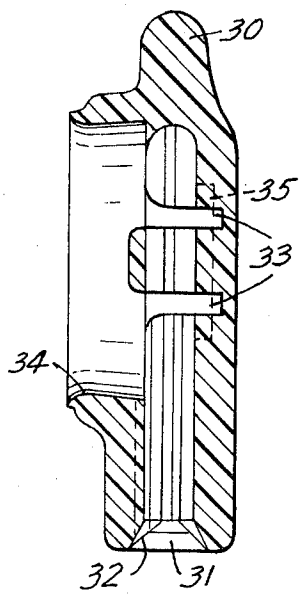


FIG. 2

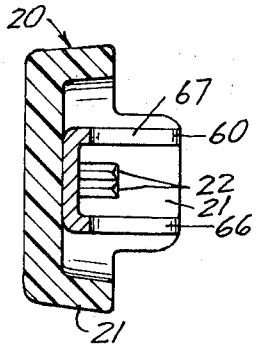


FIG. 4

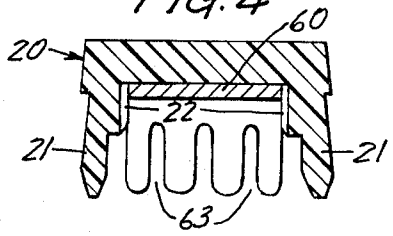


FIG. 6

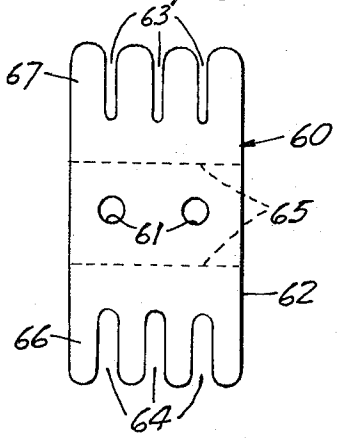
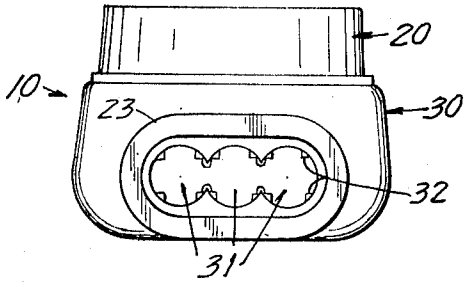


FIG. 5



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CONNECTOR

This invention relates to spring compression reserve electrical connectors of the type described in U.S. Pat. No. 3,012,219, and in particular to connectors useful in making twist-resistant long-lasting mechanical and electrical connection between insulated aluminum wires of the same or different wire-sizes.

There is provided a connector having a contact element capable of accepting and making permanent electrical contact with aluminum wires over a wide range of wire diameters while at the same time offering sufficient mechanical support to prevent shearing or breakage of the larger wires under the mechanical stresses experienced during continued use.

In the drawing,

FIG. 1 is a plan view of one embodiment of the connector of this invention,

FIGS. 2 and 3 are longitudinal sectional views of cap and body members respectively taken approximately at section 2—2 of FIG. 1,

FIG. 4 is a transverse sectional view of the cap member taken approximately at section 4—4 of FIG. 1,

FIG. 5 is a front elevational view of the connector of FIG. 1 in open wire-accepting condition, and

FIG. 6 is a plan view of a contact element prior to folding into the U shape.

The connector **10** consists generally of a forwardly extended open-topped insulative body member **30** and an insulative cap member **20**, the latter supporting a conductive contact element **60**. The body is provided with wire-receiving channels **31** passing through the forward extension **23** and in part defined by sharp wire-anchoring inner longitudinally extending corner projections **32**, and is transversely slotted to provide parallel slots **33** extending beneath the channels **31**. The circular walls **34** of the open top of the body **30** slope inwardly toward the open side and are rounded outwardly at the edge, as shown.

The cap **20** is dimensioned to provide a snap fit with the body **30** when pressed into closed position. In the open position illustrated in FIG. **5** the cap is held in place by the action of side extensions **21** which press against the walls **34**, and which fit into edge depressions **35** provided for that purpose in the body **30** when the cap is forced into the closed position. Ribs **22** located along the inner walls of the extensions **21** provide a force fit for retaining the U-shaped contact element **60** pressed therebetween. "Lexan **141-111**" polycarbonate resin is a preferred material for both body and cap, although other hard resilient insulative plastics may alternatively be used.

The contact element **60** is shown in FIG. **6** prior to folding into the U shape. It consists of a flat plate **62** of spring brass or other resilient metal, optionally perforated to provide pilot holes **61** for locating the piece during stamping, and slotted to provide opposing wire-receiving slots **63** and **64**. The plate is then folded along fold lines **65** into the U form shown most clearly in FIG. **2** and providing spaced inner and outer legs or elements.

The slots **64** in the outer leg **66**, i.e., the leg nearest the open ends of the channels **31**, are in line with, and substantially greater in width than, the slots **63** in the inner leg **67**, as may readily be seen from FIG. **6**. In a specific example the plate **62** is 0.025 inch (No. 22 B and S gage) cartridge brass, the slots **63** are each 0.016 inch wide, and the slots **64** are each 0.022 inch wide. The contact element may be plated, at least along the slot-defining edges, with a soft metal such as tin or indium.

Surprisingly, such a connector is found to be capable of making long-lasting mechanical and electrical connection between plastic insulated aluminum wires of from 17 to 24 gage, i.e., from 45 to 20 mils in diameter, i.e., from a diameter of D to somewhat more than 2D.

The width of the narrower slots **63** is preferably not greater than about four-fifths the diameter of the smallest conductor, while being great enough to permit forced entry, without severing, of the largest conductor, for which the connector is designed. For the range of wire-sizes just indicated, the slot **63** may range from about 0.012 to about 0.016 mil in width. Within these limits the plate accepts the conductor under available application pressures, and forms fully effective spring reserve contact with the conductor and without unduly weakening it.

A convenient test which has been found useful in determining the ability of a connector to resist mechanical stresses, such as flexing of the wires as may occur in use, is known as the twist test. The wire is inserted in the connector, is bent at a right angle against the end of the connector body, and is then twisted or rotated alternately 90 degrees to each side using a crank arm of about 2 inches. Under such a test, **20** gage aluminum wire in a connector having an outer slot width of 0.012 inch withstands no more than one or perhaps two test cycles before breaking, whereas smaller wires easily withstand the minimum five or ten cycles required of commercial connectors. With the width of the outer slot increased to 0.028 inch, the 20 gage aluminum wire resists up to at least about 50 test cycles; but at this slot width the connector does not provide spring reserve contact with wires smaller than No. 22 gage.

With the smaller wires it might be anticipated that the outer slot would fail to make contact with the metal conductor and therefore that the wire would remain loosely held and easily broken. In these cases it has been found that the insulation surrounding the conductor is held within the outer slot with sufficient rigidity to protect the connection at the inner slot. Larger wires are held firmly within the outer slot and are given additional support by the corners **32** which score and grip the insulating covering.

It will be appreciated that the connectors of the present invention are fully operable with insulated copper wires, which are less susceptible of breakage by twisting than are the aluminum wires; but that their major field of utility is in making long-lasting twist-resistant solderless spring reserve connection to small diameter insulated aluminum wires.

What is claimed is as follows:

1. A spring compression reserve wire-connector having spaced multiple-slotted planar interconnected inner and outer resilient contact elements wherein the wire-receiving slots of the outer element are in line with and greater in width than the corresponding slots of the inner element.

2. Wire-connector of claim 1 suitable for use with aluminum wires of diameter ranging from D to about 2D and wherein the inner slots are not more than about 4/5D in width.

3. Wire-connector of claim 1 suitable for use with aluminum wires of from 17 gage to 24 gage inclusive wherein the outer slots are about 0.022 inch in width and the inner slots are about 0.016 inch in width.

4. Wire-connector of claim 1 including an insulative body member having wire-receiving channels in line with said outer and inner slots and each containing sharp-edged elongate corner projections for inhibiting twisting of insulated wires inserted in said channels.

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