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ELECTRIC TERMINAL

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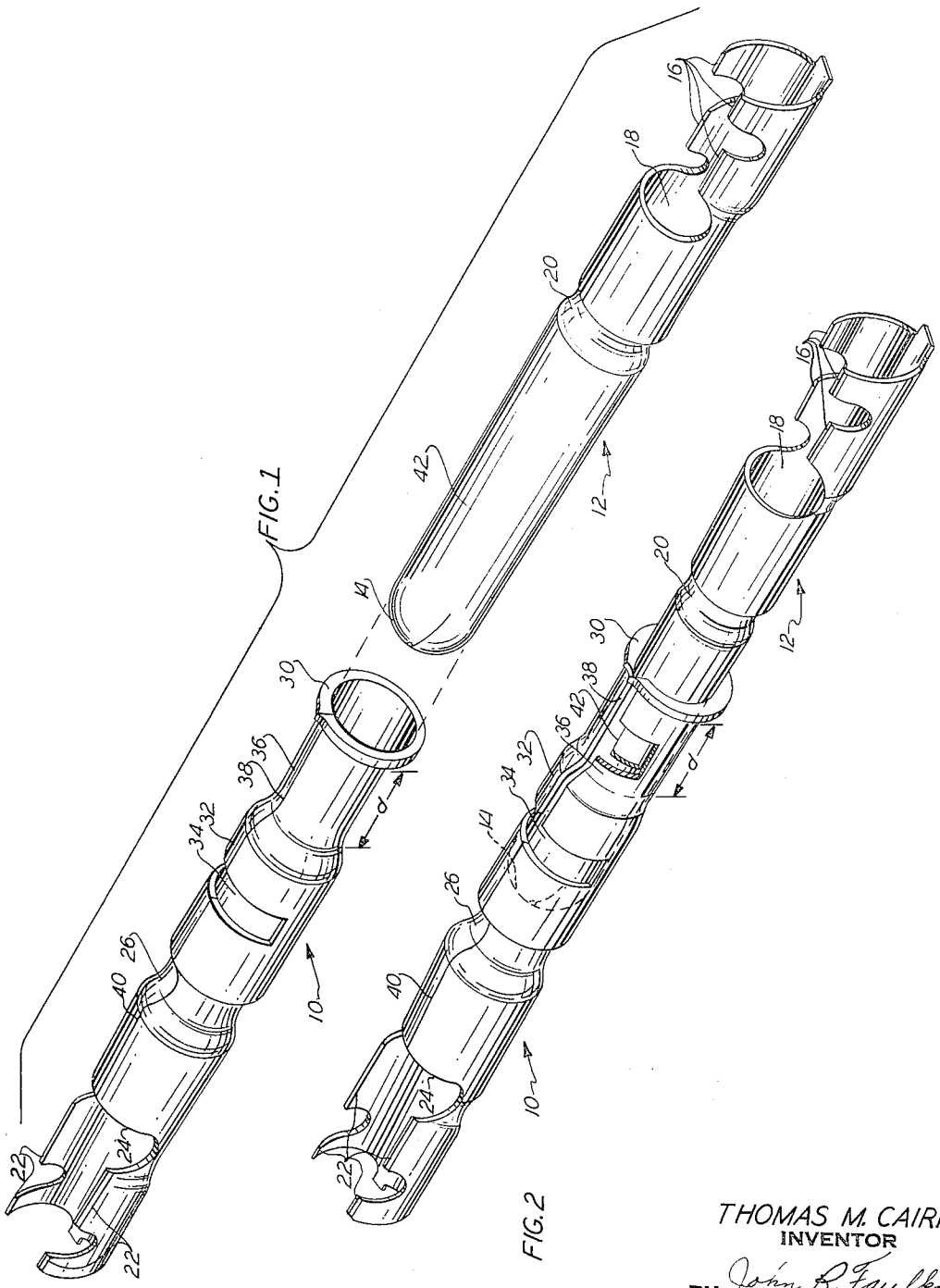


FIG. 1

FIG. 2

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ELECTRIC TERMINAL

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ABSTRACT OF THE DISCLOSURE

An electric terminal formed from a thin metal sheet has an annular body portion of a first outside diameter and an annular depressed portion of a second outside diameter. The second diameter is less than the first diameter but more than the first diameter minus two thicknesses of the metal sheet utilized to form the terminal. A slit runs along the axial length of both portions of the terminal so that the terminal may flare outwardly when coupled with a mating terminal.

BACKGROUND OF THE INVENTION

A great variety of electric terminals are available in today's market for a wide variety of applications. When a plurality of such terminals of the female type are associated with a terminal block to form a connector, an important criteria which each of such terminals must meet is that only a certain force must be required to insert a mating terminal therein. A further requirement is that when mated, the terminals must have a prescribed area of electrical contact therebetween to insure the electrical characterisics of the circuit path formed through the mated terminals. Another requirement is that the terminals must cooperate as above described after repeated couplings and uncouplings thereof.

The electric terminal of this invention is one that fulfills all of the needs set forth above. More particularly, the terminal provides a prescribed, available area of electrical contact when mated. The insertion pressure required for terminal mating does not exceed a predetermined level and is constant after the terminal has been inserted a minimum distance. Also, the terminal can be repeatedly mated without adversely affecting the electrical characteristics of the connection made therewith.

SUMMARY OF THE INVENTION

This invention relates to an electric terminal and, more particularly, to an electric terminal both wherein a predetermined contact area is guaranteed between itself and a mating terminal and wherein the mating force does not exceed a predetermined level.

An electric terminal constructed in accordance with the teachings of this invention is formed of a thin metal sheet and has an annular body portion of a first outside diameter. The terminal also has an annular depressed portion having a uniform outside diameter over at least a fixed length. The outside diameter of the annular depressed portion is less than the first diameter but more than the first diameter less two thicknesses of the metal sheet forming the terminal. A slit runs along the axial length of both the body portion and the depressed portion of the terminal.

The terminal so formed is a female terminal and the internal surface area of the annular depressed portion thereof provides the electrical contact surface area for the terminal to be mated therewith. The contact surface is of prescribed area to insure prescribed electrical characteristics for the electric connection formed by the terminal. The requirement that the annular depressed portion of the terminal have an outside diameter less than

the outside diameter of the body portion of the terminal but more than the outside diameter of the body portion less two thicknesses of the metal forming the terminal insures two characteristics of the terminal. First, the force required for mating the terminal is not extremely high and secondly, sufficient gripping pressure is applied by the terminal to insure retention of the terminal mated therewith during utilization of the electrical connection.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a schematic drawing of the female terminal of this invention shown in conjunction with a mating terminal.

FIGURE 2 is a schematic drawing showing the terminal of this invention in a mated position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Construction

In FIGURE 1 there is seen a female terminal, generally designated by the numeral **10**, and a male terminal, generally designated by the numeral **12**. The female terminal **10** is formed in accordance with the teachings of this invention. The male terminal **12**, of standard construction, has a rounded nose **14** on the leading portion thereof and wire gripping elements **16** on the rear portion thereof. The wire gripping elements **16** are folded over to connect the terminal **12** to bared wire when the wire is inserted in a receiving opening **18** of the terminal. The male terminal may have a recess **20** about the circumference thereof for a purpose fully described in my copending application Ser. No. 692,822, filed Dec. 22, 1967, and assigned to the same assignee as this application. The terminal **12** may be formed of a thin, electrically conductive sheet material such as a .012 inch thick sheet of SAE CA260 brass.

The female terminal **10**, as shown in FIGURE 1, is also manufactured from a thin, electrically conductive sheet material such as the mentioned brass material. The female terminal **10** has wire gripping elements **22** on the rear portion thereof for the purpose of engaging bared wire when the wire is inserted within a wire receiving opening **24** of the terminal **10**. The terminal **10** may also have a recess **26** about the circumference thereof for the purpose described in my mentioned copending application.

The female terminal of this invention is constructed so as to receive a mating terminal in such a manner that a guaranteed area of electrical contact is formed between the two terminals. In order to accomplish this function, the leading portion of the female terminal is of unique construction.

With specific reference to FIGURE 1, the leading portion of the female terminal **10** is of generally annular construction. As previously mentioned the terminal is formed from a thin metal sheet of electrically conductive material. The entry portion of the terminal is formed as a bell-mouth **30**. The terminal **10** also has a main body portion **32** which has a predetermined outside diameter. A slot **34** is formed after the main body portion of the terminal for a purpose to be described subsequently. The slot **34** extends along the axis of the terminal for a small distance and extends around the circumference of the terminal a distance of not more than 180° of arc. The slot **34** separates the elastic, leading portion of the terminal from the static, rear portion of the terminal.

An annular depressed portion **36** of the female terminal **10** is shown intermediate the main body portion **32** and the bell-mouth **30**. The depresed portion **36** extends along the axial length of the terminal **10** for a distance *d* and may be formed in the terminal by a rolling

operation. The diameter on the outside surface of the annular depressed portion **36** of the terminal is controlled so that it is less than the predetermined outside diameter of the body portion **32** but more than the predetermined outside diameter of the body portion less two metal thicknesses of the material utilized to form the terminal. The criticalness of this dimension will be explained in the "Operation" portion of this specification.

A slit **38** runs along the axial length of the leading portion of the terminal **10** from the bell-mouth **30** to the slot **34**. Similarly, a slit **40** extends from the slot **34** to the wire receiving opening **24** in the rear portion of the terminal **10**. The slits **38** and **40** are formed as a result of the rolling of the terminal and have as opposing surfaces thereof the opposite lateral edges of the metal blank utilized to form the terminal.

Operation

The operation of the electric terminal constructed in accordance with the teachings of this invention will be described with reference to FIGURE 2 of the drawings. FIGURE 2 shows the female terminal of this invention in an assembled condition with a suitable mating terminal.

In assembling the terminal, the nose **14** of the terminal **12** is brought into engagement with the bell-mouth **30** of the terminal **10** and pressure is applied to move the terminal **12** axially into the terminal **10**. A fully inserted condition is achieved when the nose **14** of the terminal **12** proceeds significantly beyond the end of the annular depressed portion **36** of the female terminal **10**. During the insertion of the terminal **12**, the slit **38** opens up uniformly along its length.

As was previously described, the outside diameter of the depressed annular portion **36** of the female terminal **10** is less than the predetermined, outside diameter of the main body portion **32** of the terminal. However, the outside diameter of the depressed portion is more than the predetermined, outside diameter of the main body portion less two thicknesses of the metal utilized to form the terminal. The diameter of the depressed portion **36** is so controlled to insure that the force required to mate the terminals **10** and **12** does not exceed a predetermined limit. More particularly, depression of the annular portion **36** significantly beyond that described, namely, two metal thicknesses, substantially increases the insertion pressure required to mate the terminal well above a normal insertion force range of 1 to 3 pounds of force. This increased insertion force is the result of the increased pressure applied to the contact surface area of the terminal **10** by the interior surface area of the depressed portion **36** of the terminal **12**. This increased pressure means that the terminals cannot be easily uncoupled after they are once mated.

The length of the dimension *d* of the annular depressed portion **36** of the female terminal **10** controls the electrical contact area between the terminals **10** and **12**. More particularly, as seen in FIGURE 2, the internal surface area of the depressed portion **36** is in physical engagement with a contact surface area **42** of the terminal **12** to provide the electrical junction area between the terminals. Once the terminal **12** is inserted to a position where the nose **14** passes beyond the depressed portion **36**, further insertion of the terminal **12** does not increase the amount of electrical junction area between the terminals nor does it increase the insertion force. The controlled junction area thus permits a predetermined electrical characteristic for the electrical junction between the two terminals.

The axial slot **34** in female terminal **10** permits the leading portion of the terminal to be elastic and to open freely along the slit **38**, the slit **38** opening uniformly from front to rear as the nose **14** of the terminal **12** proceeds into the terminal **10**. The exact location of the slot **34** between the recess **26** and the depressed portion **36** controls the maximum amount of insertion force required to insert the terminal **12**. More particularly, as the slot

34 is moved to the rear or left, as viewed in FIGURE 2, the amount of metal which must be separated as the terminal **12** is inserted is increased and, therefore, the insertion force is increased. Therefore, the exact position of the slot **34** gives an accurate control as to the amount of insertion force necessary to insert and mate the terminals.

As previously mentioned, the slot **34** allows the slit **38** along the length of the leading portion of the female terminal **10** to open uniformly upon insertion of the terminal **12** therein. Such a uniform opening of the slit **38** permits uniform and accurate contacting of the internal surface area of the depressed portion **36** of the terminal **10** and the contact surface area **42** of the terminal **12**. The internal surface area of the depressed portion **36** of the terminal **10** and the contact surface area **42** of the terminal **12** form parallel contact surfaces and such uniformity in contact insures that the electrical junction formed between the two terminals is of a prescribed quality.

In a typical construction of the terminal **12** utilizing .012 inch thick SAE CA260 brass sheet, the O.D. of the main body portion **32** was .150 to .146 inch and the O.D. of the depressed portion was .126 to .122 inch. The length *d* of the depressed portion was .120 inch and the slot **34** was .04 inch wide and the leading edge thereof was located .240 inch from the bell-mouth **30**. This terminal construction had an average insertion force for terminal mating of two pounds of force.

There has been disclosed herein a terminal of such construction that no more than a controlled, predetermined maximum insertion effort is required to insert a mating terminal therewithin. The terminal is also of such construction that a uniform quality junction is consistently formed between mated terminals. Further, the construction is relatively inexpensive to manufacture and of superior value in forming electrical connectors.

The invention disclosed will have many modifications which will be apparent to those skilled in the art in view of the teachings of this specification.

What is claimed is:

1. In an electric terminal formed from a thin metal sheet: a substantially annular body portion of a first outside diameter; an annular depressed portion coaxial with said body portion, said annular depressed portion having a uniform outside diameter over at least a fixed length which diameter is less than said first diameter but more than said first diameter less two thicknesses of the metal sheet forming the terminal; and a slit running along the length of both said body portion and said annular portion.

2. In an annular, electric terminal formed from a thin metal sheet: an entry portion; a body portion of a first outside diameter; a depressed portion interconnecting said body and entry portions, said depressed portion having a uniform outside diameter over at least a fixed length which diameter is less than said first diameter but more than said first diameter minus two thicknesses of the metal sheet forming the terminal; and a slit running the axial length of at least said body portion and said depressed portion of said terminal.

3. The electric terminal as defined in claim **2** further including a slot in said body portion of said terminal, said slot both extending across and along the axis of said body portion and intersecting said slit.

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