Feb. 16, 1971 H. R. UPSTONE ET AL 3,564,487

CONTACT MEMBER FOR ELECTRICAL CONNECTOR

Filed Feb. 3, 1969

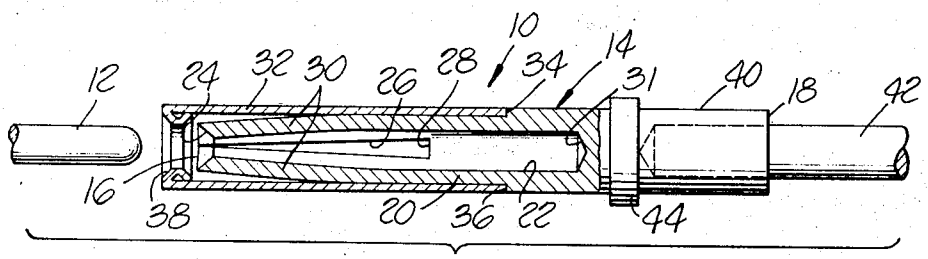

FIG. 1. (PRIOR ART)

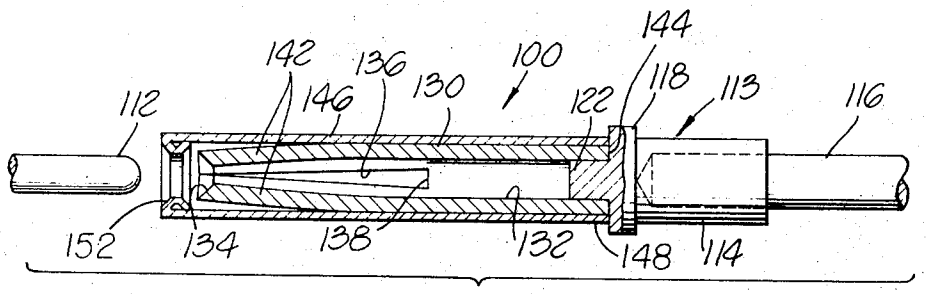

FIG. 2.

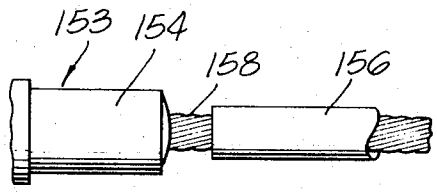

FIG. 3.

HARLAN R. UPSTONE
BRUCE K. ARNOLD
INVENTORS.

BY Harvey J. Hertz

ATTORNEY

United States Patent Office 3,564,487 Patented Feb. 16, 1971

3,564,487

CONTACT MEMBER FOR ELECTRICAL CONNECTOR

Harlan R. Upstone, Arcadia, and Bruce K. Arnold, Pasadena, Calif., assignors to International Telephone and Telegraph Corporation, New York, N.Y., a corporation of Delaware

Filed Feb. 3, 1969, Ser. No. 796,083
Int. Cl. H01r 11/08, 11/22
U.S. Cl. 339—258 3 Claims

ABSTRACT OF THE DISCLOSURE

The disclosure relates to a socket contact for an electrical connector having an elongated contact body with rearwardly terminating means and having a tubular forward portion. The tubular forward portion containing a forward opening longitudinal slot therein has spring contact fingers having their roots at the rear end of the slot. A sleeve is provided above said fingers and secured proximate their roots thereof. The terminating means, the spring fingers, and the sleeve means are each made of material which provides the desired performance parameter of that particular component. For example, the spring fingers utilize material which has good spring characteristics as well as maximum conductivity. The terminating means may be formed of a material which is readily crimpable.

The invention relates in general to contact members for electrical connectors, and more particularly, to a socket contact having a terminal member, a spring member, and a tubular sleeve each made of materials which best matches the performance parameters needed for the particular component.

BACKGROUND OF THE INVENTION

In United States Pat. No. 3,286,222 there is described an electrical contact member having forwardly ertending spring fingers which flex laterally upon mating with an opposed contact member. The spring fingers are prestressed in their positions of repose in a direction opposite to the direction of stressing encountered in service. By so prestressing the spring fingers, the contact material spring characteristics are increased proximate the roots of the spring fingers and thereby increase the spring force exerted by the fingers on the mating contact member. Moreover, the amount of flexing which the spring fingers are capable of withstanding in operation or during deep probing is increased without exceeding the elastic limits and thereby causing permanent damage to the fingers.

The prime purpose of prestressing the spring fingers in the above identified patent is to overcome the inherent disadvantages of having the spring fingers in a cantilever arrangement projecting free from a tubular base which results in maximum pin stress from outward flexing by a mating pin being applied proximate the root of the spring fingers. This results in relatively weak contacting force between the socket fingers and the mating pins, much less than the actual spring capability of the spring fingers along their length.

Further, the fact that the pin stress was at a maximum proximate the roots of the spring fingers had the further disadvantage that when the fingers were flexed outwardly by a mating pin contact, the elastic limits or yield strength of the material were often approached; and when a test probe was inserted in the socket contact without proper care, there was a possibility that the elastic limits or yield strength of the material would be exceeded and

the fingers would take a permanent set and thereby lose most of their spring capability.

While the foregoing technique of prestressing the spring fingers has been successful, certain compromises of materials and finishes of the main body and spring fingers have become readily apparent as the need for very small contact configurations has increased in demand. Ideally, the engaging end of a typical socket contact utilized spring fingers and necessitated the use of a material which has good spring characteristics. Conversely, the terminal end part is a crimp-type contact requiring a material which is highly ductile using a minimum of springback. Moreover, in conventional contact configurations, it is difficult to achieve uniform deposition of the electro-plated precious metal finishes which may be required. This problem is more apparent when trying to plate deep, semi-blind bores in small contacts having very small bore diameters.

In order to overcome the attendant disadvantages of the prior art of electrical connectors having a socket utilizing spring fingers, the present invention allows selection of the material and finish for each segment of the connector which best matches the performance parameters of that particular component. Moreover, by using multi-piece construction for the contact body, it is possible to utilize material forms and manufacturing processes better suited to fabrication than those presently employed. Further, by handling and finishing the components of the connector as separate pieces prior to assembly, the problems attendant to finishing conventional socket connectors are greatly reduced.

SUMMARY OF THE INVENTION

More particularly, the invention comprises a socket contact for an electrical connector having an elongated contact body with rearwardly terminating means and having a tubular forward portion. The tubular forward portion containing a forwardly-opening longitudinal slot therein contains spring contact fingers having their roots at the rear end of the slot. Sleeve means are provided above said fingers and secured proximate their roots. The terminating means, the spring fingers, and the sleeve means are each made of a metal which provides the desired performance parameters of the particular component.

The advantages of this invention both as to its construction and mode of operation will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like reference numerals designate like parts throughout the figures.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an axial section, partly in elevation, illustrating the socket contact member of the prior art with a mating pin contact member positioned for insertion into the socket;

FIG. 2 depicts an axial section, partly in elevation, illustrating the socket contact member according to the present invention; and

FIG. 3 shows an alternative arrangement for terminating the contact member of FIGS. 1 and 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, there is shown in FIG. 1 a prior art socket contact member **10** which is shown axially in spaced relationship with a mating pin contact

member **12** which is adapted to be forcibly inserted into the forward end of the socket to complete an electrical circuit.

The socket contact **10** includes an elongated body **14** having a front end **16** and a rear end **18**. The forward engaging contact portion **20** of the socket contact member **10** is of tubular construction having a forward opening bore **22** with a bevelled entrance ramp **24**. The tubular engaging portion is slotted longitudinally down the middle by a slot **26** which extends to the front end **16** and to a rearward end **28** of the slot so as to divide the engaging portion of the socket into a pair of diametrically opposed spring fingers or legs **30**. These are pinched together to reduce the diameter of the entrance of the tube so that when the pin contact member **12** is inserted, it will flex the fingers **30** outwardly and the fingers will exert a spring contacting force against the pin. The rear end **28** of the slot is disposed forward of the rear end **31** of bore **22**.

Circumferentially engaged about the tubular forward portion **20** is a sleeve **32**. A rear end **34** of the sleeve **32** is disposed to the rear end of the slot **28** and is positioned against a forwardly facing shoulder **36** on the body. The sleeve **32** extends forwardly beyond the slot end of the contact body and has an in-turned forward lip **38** which provides a rigid guide for the mating pin **12**.

The contact body **14** has a tubular rearward terminating portion **40** adapted to receive a bared end of a wire **42** which is crimped therein. A mounting collar **44** is formed on the contact portion **14**. The rearward portion of the sleeve **32** is tightly engaged over the annular portion of the socket tube immediately to the rear of the slot and against the contacting fingers approximate their roots, i.e. immediately adjacent to and extending somewhat forwardly of the rear end of the slot. The circumscribed part of the socket tube is placed in hoop compression and the root portions of the spring contacting fingers are radially inwardly stressed substantially to the point of elastic limit.

The effect of the prestressing by compression sleeve **32** is to greatly increase the spring characteristics of the contact material of the critical region proximate and adjacent to the spring fingers. With prestressing substantially to the elastic limit the spring characteristics are substantially doubled, which substantially doubles the spring force of the contact fingers against the mating pin contacting member. Further, when the spring fingers are flexed outwardly by a mating pin contact or by a test probe they will not approach their yield strength or elastic limit nearly so closely as they would if it were not for the prestressing of the compression sleeve **32**.

Normally, the outer sleeve is made typically of a stainless steel or copper alloy. The socket body **14** is made of a suitable conductive alloy such as nickel-copper which allows the fingers **30** to be springable while simultaneously allowing the terminating portion to be crimped to the wire conductor **42**. Thus, as can be readily seen, the tubular body **14** is a compromise between the spring characteristics and the crimp characteristics needed to provide the desired electrical contact.

Referring now to FIG. 2, there is shown a preferred embodiment of the invention wherein a socket contact member **100** is made of three portions for mating with a pin contact member **112**. The socket contact **100** comprises a terminating member **113** having a tubular rearward terminating portion **114** attached to receive a bared end of a wire connector **116** which is crimped therein. A mounting collar **118** is formed forward of the terminating portion **114**. A reduced diameter cylindrical member **122** is formed forwardly extending from the collar **118**.

A spring member **130** is formed of a bore **132** and a bevelled entrance ramp **134** at its forward end. The spring member **130** is slotted longitudinally down the middle by a slot **136** which extends from the front end of the member **130** at the bevelled entrance ramp to a rearward end **138** of the slot so as to divide the engaging portion of the

spring member into a pair of diametrically opposed spring fingers **142**. It should be understood, of course, that the number of fingers used is merely a matter of design. The spring fingers **142** are pinched together as in the device of FIG. 1 to reduce the diameter at the entrance, so that when the pin contact member **112** is inserted it will flex the fingers **142** outwardly and the fingers will exert a spring contacting force against the pins. The rear end of the spring member **130** is slipped over the reduced diameter cylindrical member **122** and its rear end **144** abuts the forward face of the collar **118**. Circumferentially surrounding the spring member is a sleeve **146**.

The spring member **130** may be brazed or soldered to the member **122** and to the collar **118**, or may be retained by elastic forces generated by a tight fit or pressed on sleeve **146**. The sleeve **146** contains a rear end **148** which may be pressed, brazed or soldered to the terminating member **113**, and to the rear portion of the spring member **130** in the vicinity of the cylindrically extending member **122**. The sleeve extends forwardly beyond the front end of the spring member **130** and contains an in-turned forward lip **152** that provides a rigid guide for the mating pin **112**. The terminating member **113** is normally made of a malleable copper alloy or other suitable conductive material which is crimpable about the conductor **116**. This material may be selected primarily for its good crimping characteristics. The outer sleeve **146** can be made of a material such as stainless steel or copper alloy as in the device of FIG. 1. The spring member **130** is chosen of spring material having maximum conductivity such as beryllium copper, a Phosphor bronze alloy or a cadmium-copper alloy which combines the characteristics of good conductivity as well as having good mechanical spring. In the device of FIG. 1, normally a nickel copper alloy was utilized for the member **14** which had spring characteristics and still was crimpable. However, such material was a compromise for both the crimping and the spring characteristics. In the device of FIG. 2, because of the choice of spring material, it is no longer necessary to prestress the spring member **130** by means of a compression sleeve as the material now has the desired spring characteristics. However, should even greater spring characteristics be desired, the sleeve **146** could be used as a compression sleeve for prestressing.

Referring now to FIG. 3 there is shown an alternative terminating member **153** for use with the contact member of FIG. 2. The terminating member contains a terminating portion **154** which may be butt welded to the conductor **156**. In such a case, the terminating end portion would be a flat ended post to which the conductor wire **158** of conductor **156** would be welded. The terminating member material could then be chosen to have the desired characteristics necessary for a welded termination.

The multiple piece construction for the contact body allows the utilization of material forms and manufacturing processes better suitable to fabrication than those of a single contact body construction. By handling and finishing each of the components as separate pieces before assembly the problems attendant to finishing typical to conventional single body constructions are greatly reduced.

What is claimed is:

1. A socket contact for an electrical connector comprising: a contact body having rearward terminating means being made of a material which may readily be secured to a conductor; and a tubular spring member being made of a material having high conductivity and good spring characteristics and being formed of a hollow cylinder open at both ends and having a plurality of forwardly opening longitudinal slots extending from the forward end of said spring member to part way along its length to provide a plurality of forwardly extending contact spring fingers, said spring member being secured at its rear end to said rearward terminating means; the forward end of said terminating mens having a cylindrical appendage to fit contiguously to the rear internal surface

of said spring member, said terminating means having a radial flange to fit contiguous to the rearward end of said spring member, said flange extending radially beyond the external surface of said spring member, and a cylindrical sleeve to fit contiguously to the external surface of said spring member, said sleeve having one end positioned contiguous to said flange; said terminating means, said spring member and said sleeve being fixed together.

2. A socket contact in accordance with claim 1 wherein said rearward terminating means is made of a material which may be readily crimped around said conductor.

3. A socket contact in accordance with claim 1 wherein said rearward terminating means is made of a material which may be readily welded to said conductor.

References Cited

UNITED STATES PATENTS

465,430	12/1891	Desant	339—262X
2,942,231	6/1960	Cornell	339—258
3,003,135	10/1961	Purinton	339—258X
3,101,983	8/1963	Van Horssen	339—262X
3,170,752	2/1965	Van Horssen	339—258X
3,286,222	11/1966	Drinkwater	339—258

IAN A. CALVERT, Primary Examiner

U.S. Cl. X.R.

339—276