

[54] PIN AND SOCKET TYPE ELECTRICAL CONTACT TERMINALS

[75] Inventors: Warren David Nauman, Elizabethtown; Clair William Yerger, Hershey; Robert Lee Douty, Millersburg, all of Pa.

[73] Assignee: AMP Incorporated, Harrisburg, Pa.

[22] Filed: June 5, 1972

[21] Appl. No.: 259,645

[52] U.S. Cl. 339/217 S, 339/256 R, 339/276 SF

[51] Int. Cl. H01r 9/08

[58] Field of Search 339/217 R, 217 S, 223 R, 339/276 R, 276 T, 276 SF, 211, 213 T, 204, 205, 256 R, 258 R, 258 P

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Primary Examiner—Bobby R. Gay

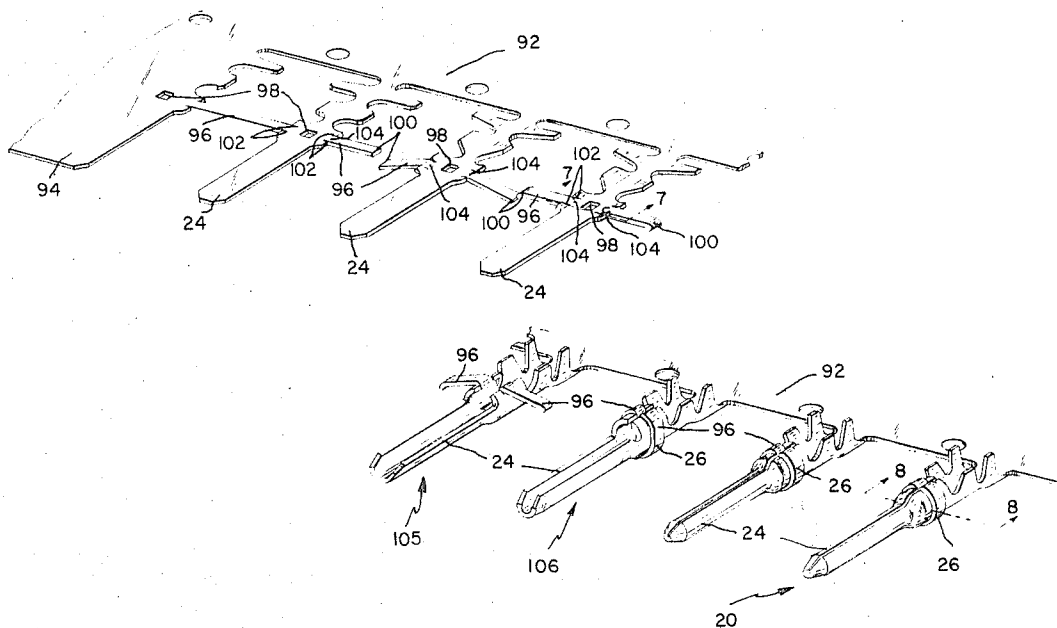
Assistant Examiner—Robert A. Hafer

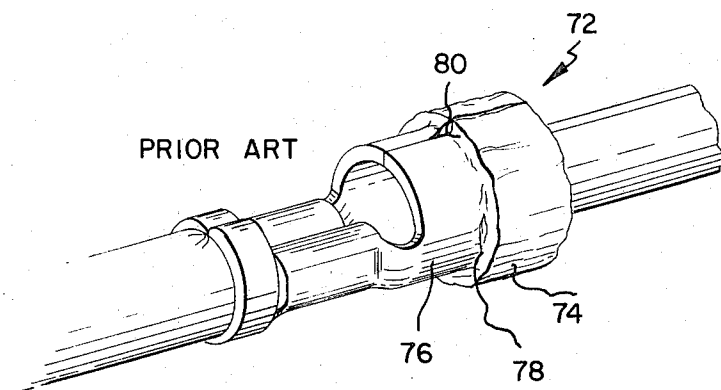
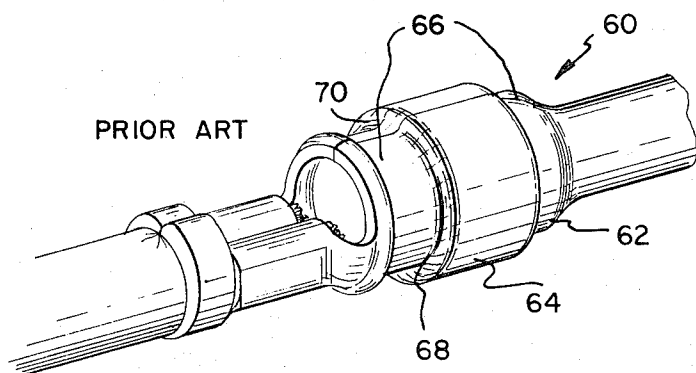
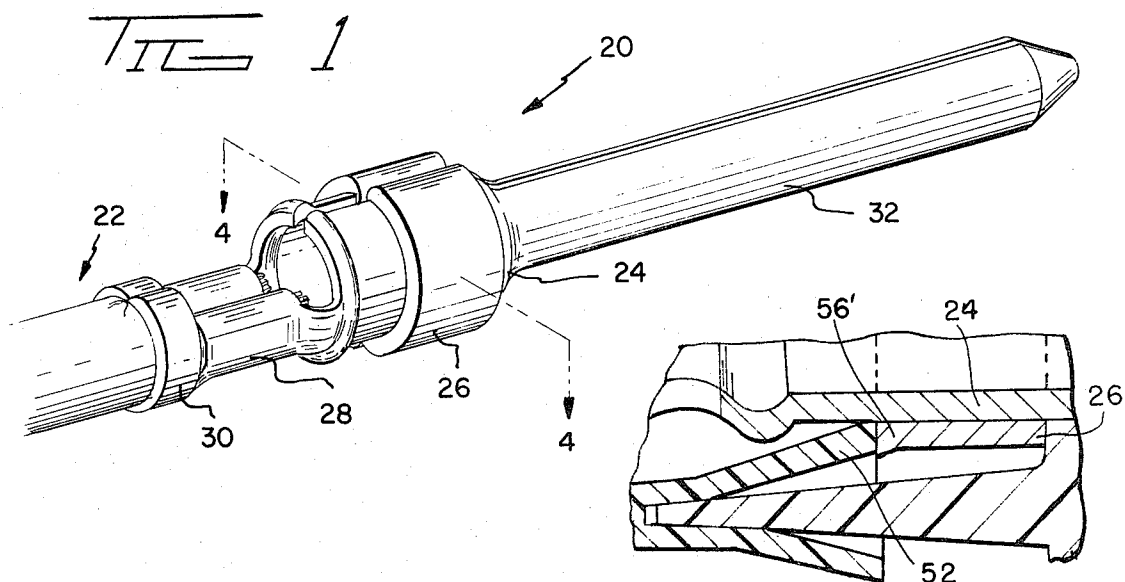
Attorney, Agent, or Firm—William J. Keating

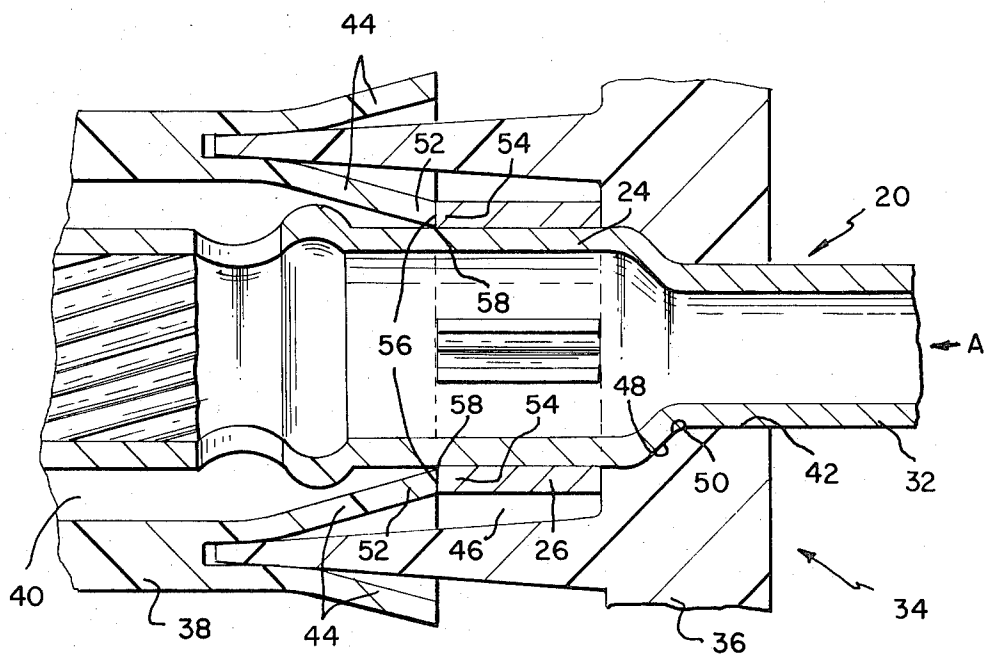
[57] ABSTRACT

The present invention relates to a pin or socket type contact terminal comprising integrally stamped and formed terminal body and terminal collar. The terminal body includes a formed cylinder having an axially extending open seam and the terminal collar is formed to coaxially encircle the terminal body. The collar provides a surface extending laterally of the cylindrical surface of the terminal body upon which a snap-in retention means associated with a terminal housing acts to prevent unintentional withdrawal of the contact terminal from the housing.

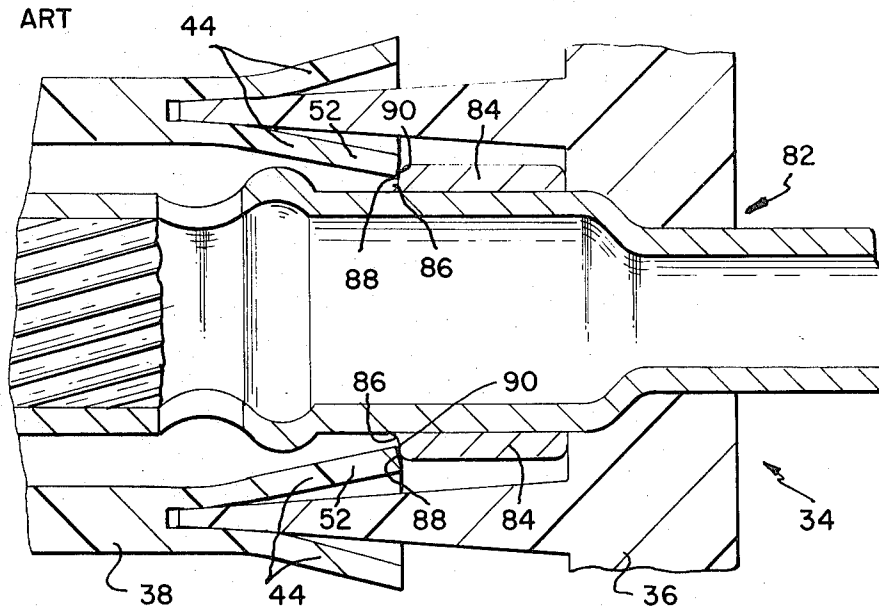
12 Claims, 15 Drawing Figures

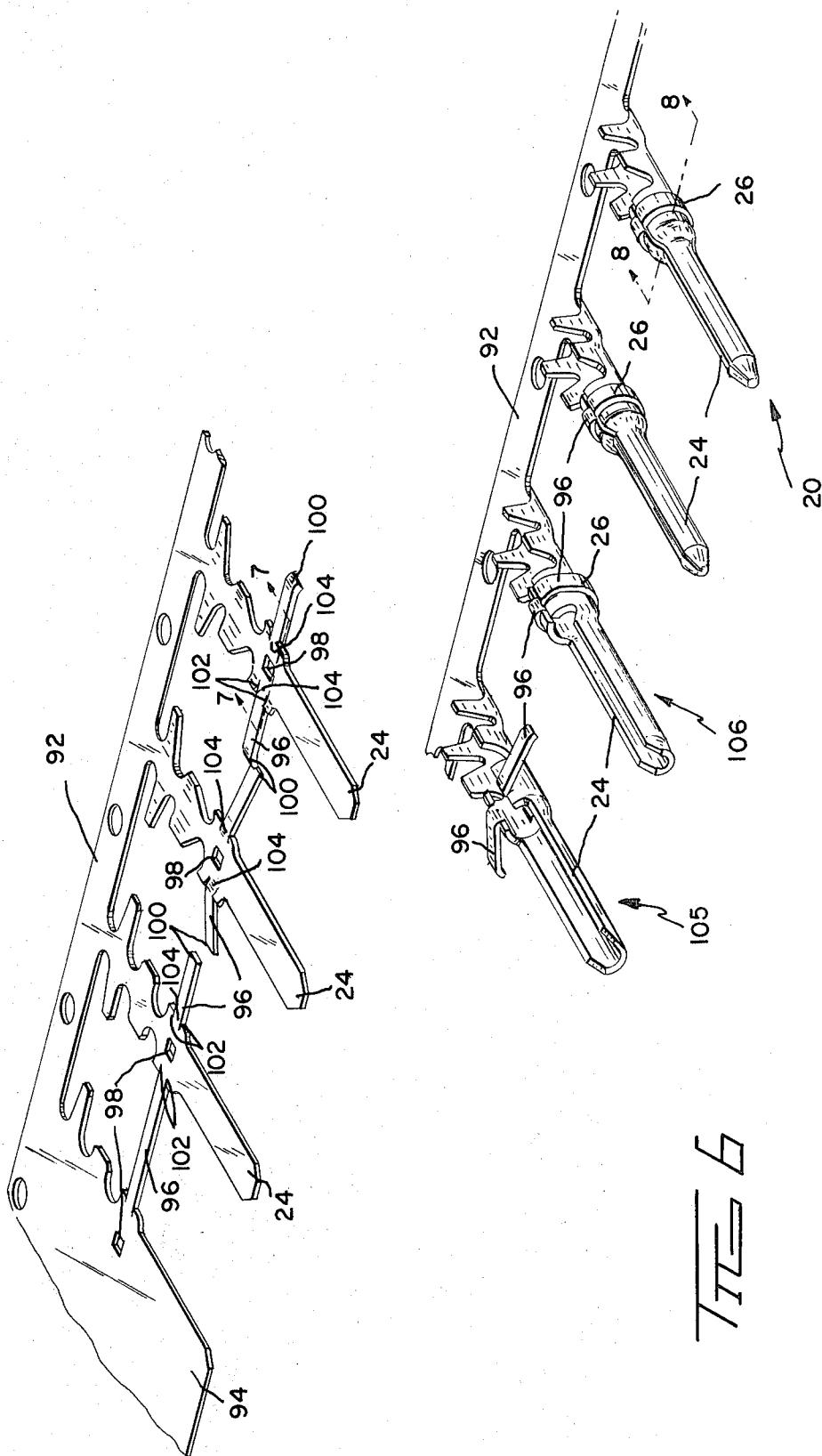




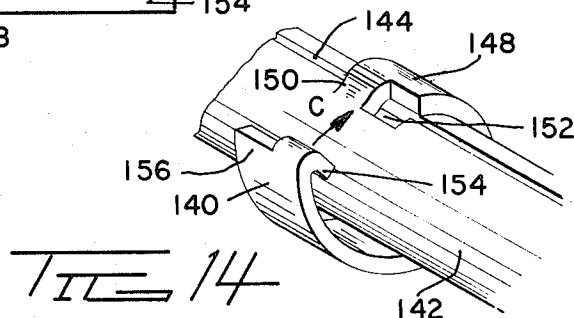
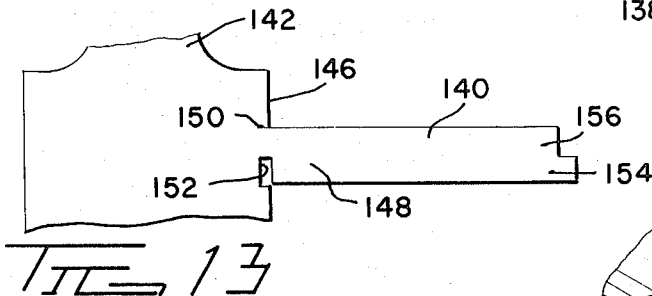
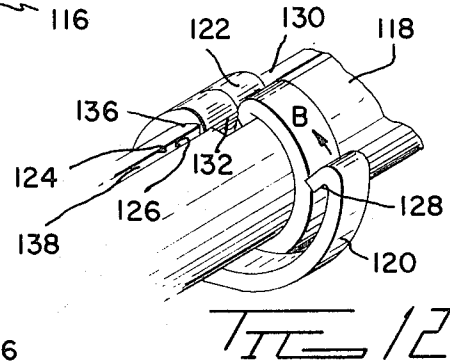
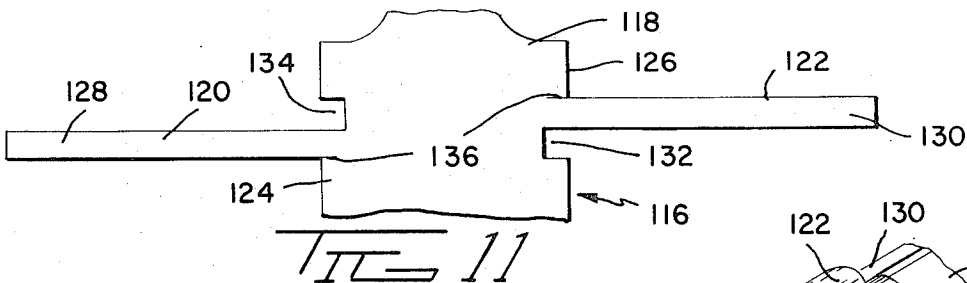
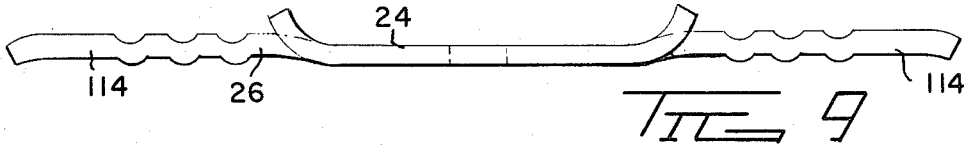
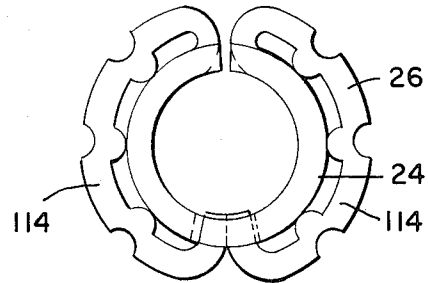
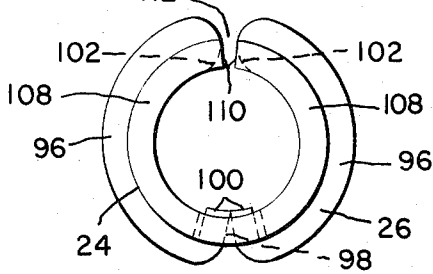
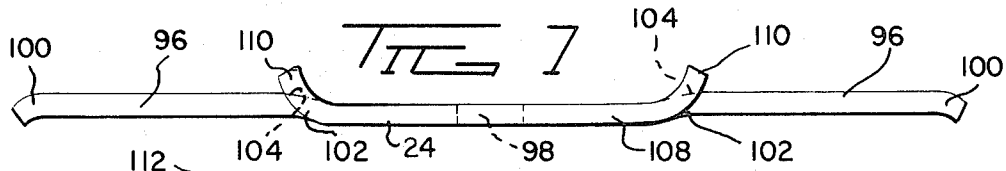


PRIOR ART





SHEET 4 OF 4



PIN AND SOCKET TYPE ELECTRICAL CONTACT TERMINALS

BACKGROUND OF THE INVENTION

It is desirable in the manufacture of some pin and socket type electrical contact terminals to have the terminal stamped and formed from sheet metal rather than screw machined from bar stock. The finished contact terminals are generally mounted within a multi-contact electrical connector member and are mateable with other contact terminals similarly mounted within another multi-contact electrical connector member. To prevent withdrawal of the contact terminals from one type of connector member frequently utilized, it has been necessary to provide the contact terminal with an intermediately positioned collar with which a retention system mounted within the connector member can engage. Retention fingers associated with the system extend forwardly from the interior wall of the contact terminal housing toward the terminal body and their forward edges press against the trailing edge of the collar, to prevent withdrawal as disclosed in U.S. Pat. No. 3,165,369.

There have heretofore primarily been two stamping and forming methods utilized to obtain a contact terminal having a collar to facilitate retention. One method employs relatively expensive premilled stock which, when stamped and formed, produces a contact terminal having a preselected band of thicker base material encircling the terminal body and extending laterally thereof to form a collar. The other method requires the terminal body, after stamping and forming, to be upset by axial compression to form an annular collar at the desired location. However, when producing relatively small contact terminals, these methods have not been found to be entirely satisfactory.

It is desirable to manufacture stamped and formed pin and socket contact terminal from sheet metal as thin as 0.0084 inches, having a length of approximately 0.750 inches and a collar extension of about 0.0085 to 0.0110 inches. To adequately retain contact terminals having these relatively small dimensions, it is essential that the surface of the collar upon which the retention means act be substantially perpendicular to the surface of the cylindrical terminal body and that these two surfaces intersect substantially right-angularly. Neither method hereinabove described has consistently produced such a collar. Consequently, the retention fingers associated with the connector member do not have a sufficiently large or adequately terminated perpendicular surface upon which to act.

It is therefore an object of this invention to provide a stamped and formed contact terminal having an integral collar at an intermediate portion of its body to engage with a retention means associated with a terminal housing to prevent unintentional withdrawal of the terminal from the housing.

It is also an object to provide a terminal of the type described which can be manufactured inexpensively from sheet metal of uniform thickness.

It is a further object to provide a terminal of the type described wherein a trailing edge of the collar includes a surface which is substantially perpendicular to the axis of the terminal.

It is a further object to provide a terminal of the type described in which a region adjacent the intersection of

the trailing surface of the collar and the cylindrical surface of the terminal body is free of base material for unobstructed engagement by the retention means.

It is also an object to provide a terminal of the type described including means for securing the extended end of the ear means which form the collar to the terminal body to improve the integrity of the collar and to resist deformation of the terminal body.

It is also an object to provide method of manufacture of the terminal of the type described.

It is also an object to provide method of manufacture of the type described including a means for providing a collar having a height greater than the thickness of the base sheet metal from which it is formed and having a trailing surface which is undercut to further improve engagement by the retention means.

Other objects and advantages of this invention will become known by reference to the following description and the accompanying drawings, in which:

FIG. 1 is a perspective view of a preferred embodiment of the invention as installed on a wire end;

FIG. 2 is a fragmentary perspective view of one prior art embodiment;

FIG. 3 is a fragmentary perspective view of another prior art embodiment;

FIG. 4 is a sectional view of the embodiment as seen along line 4—4 in FIG. 1 and as installed and retained within a housing;

FIG. 4a is a fragmentary sectional view of an alternative collar for the embodiment shown in FIG. 4;

FIG. 5 is a fragmentary sectional view of a prior art embodiment as installed in a housing;

FIG. 6 is a perspective view of the preferred embodiment in sequential stages of stamping and forming;

FIG. 7 is a view of the embodiment as seen along lines 7—7 in FIG. 6;

FIG. 8 is a view of the embodiment as seen along line 8—8 in FIG. 6;

FIG. 9 is a view like that in FIG. 7 of an alternative embodiment of the invention;

FIG. 10 is a view like that in FIG. 8 of the alternative embodiment shown in FIG. 9;

FIG. 11 is a fragmentary top view of another alternative embodiment of the invention as stamped prior to formation;

FIG. 12 is a fragmentary perspective view of the embodiment shown in FIG. 11 at final formation;

FIG. 13 is a fragmentary top view of still another alternative embodiment of the invention as stamped prior to formation; and

FIG. 14 is a fragmentary perspective view of the embodiment shown in FIG. 13 at final formation.

In the disclosed invention, sheet metal is stamped to produce a pin or socket contact terminal body having an elongated ear means extending from an intermediate portion of one of the two edges of the terminal body which after formation define an axially extending open seam in the cylindrical terminal body. The elongated ear means is subsequently formed to encircle the cylindrical terminal body and provide a annular collar thereon.

Referring to the drawings, FIG. 1 shows a preferred embodiment of the invention, generally designated at 20, after formation and as installed on a wire end 22. Although in this and other figures a pin type contact terminal is depicted, the description and specification herein provided are equally applicable to a stamped

and formed socket type contact terminal including the various features of the disclosed invention. The terminal 20 comprises a tubular terminal body 24, an integral collar 26, the formation of which will be discussed in detail later, and a pair of U-shaped crimped portions 28 and 30, which are crimped in a manner known in the art onto the stripped end and the insulation respectively of the wire end 22. The terminal body 24 includes a leading end 32 for insertion into and mating with a socket type contact terminal (not shown).

As shown in FIG. 4, the terminal 20 is housed with a plurality of identical terminals within a connector member 34 having an insulating front face 36 and an insulating rear face 38. To install the terminal 20 in the connector member 34, the faces 36 and 38 of the connector member 34 are joined one to the other and the leading end 32 of the terminal 20 is inserted into coaxially aligned openings 40 and 42 in the rear face 38 and front face 36 respectively. A pair of retaining fingers 44 of the rear face 38 are biased toward the terminal body 24 as shown but are expanded by the collar 26 during insertion to allow the collar 26 to pass into a cavity 46 defined by the adjacent walls of the rear face 38 and the front face 36 and disposed therebetween. When fully installed with the leading end 32 of the terminal 20 extending beyond the front face 36, further insertion of the terminal 20 is prevented by the mating of a shoulder 48 on the terminal body 24 against a tapered edge 50 of the opening 42. Withdrawal of the terminal is prevented by the retention fingers 44 which are biased toward the terminal body 24 so that an extended end 52 of the retention fingers 44 makes contact with a trailing edge 54 of the collar 26. When a force, as indicated by the arrow A, is applied to the terminal 20 to attempt withdrawal, the extended ends 52 of the retention fingers 44 press against a surface 56 of the trailing edge 54 of the collar 26. The surface 56 is substantially perpendicular to the axis of the terminal 20 and, because of the inclination of the retention fingers 44, the application of withdrawal force A causes the extended ends 52 to slide along the surface 56 toward the terminal body 24 to insure engagement with the collar 26 even as the withdrawal force A is increased. Because the concentric formation of the terminal body 24 and the collar 26 is attained by super-imposing one layer of base sheet metal on another, there is no base metal in a region 58 adjacent their union to interfere with the inward movement of the unattached ends 52 of the retention fingers 44 or the self-locking feature which they provide.

However, as shown in FIGS. 2 and 3, prior art stamped and formed contact terminals having integral collar but being manufactured by methods described hereinabove, do not effectively satisfy the requirements for proper retention. In FIG. 2, a terminal 60 having a terminal body 62 and a terminal collar 64 is formed from premilled sheet metal which having a thickness sufficient to form the collar 64 is reduced by milling in a region 66 to provide for the formation of the relatively thin-walled terminal body 62. However, the limitations of milling tools are such that a fillet 68 remains at the base of the collar 64 to produce a trailing surface 70 in the collar 64 which is not uniformly perpendicular to the axis of the terminal 60. Although a terminal 72 shown in FIG. 3 includes a collar 74 which is formed by the application of axial compression to upset a pre-formed terminal body 76, a fillet 78 at the base of the

collar 74 and a curved trailing surface 80 likewise remain to interfere with proper retention.

FIG. 5 accordingly shows a prior art terminal 82 as installed within the connector member 34. Because a collar 84 includes a fillet 86 and a trailing surface 88 having only a narrow portion 90 which is perpendicular to the axis of the terminal 82, the extending ends 52 of the retention fingers 44 do not properly engage the collar 84. Attempts to withdraw the prior art terminal 82 from the connector member 34 are not effectively prevented by the self-locking feature described hereinabove which the retention fingers 44 would otherwise provide.

The preferred embodiment of the disclosed contact terminal 20 is sequentially stamped and formed, as shown in FIG. 6, while extending perpendicularly from a strip 92 and affixed thereto. Initial stamping of the sheet metal 94 reveals the terminal body 24 and a pair of ear means 96 which are eventually formed into the collar 26. An opening 98 is stamped in the terminal body 24 in alignment with the ear means 96 and adapted to eventually receive an extended end 100 of each ear means 96. Also provided are a plurality of incisions 102 in the terminal body 24 at a base 104 of ear means 96. The function of the incisions 102 is described in detail later.

It can be seen generally at 105 that the basic formation of the contact terminal 20 having the integral collar 26 is accomplished by the U-shaped formation of the terminal body 24 while the ear means 96 extend outwardly and downwardly therefrom. At 106 the ear means 96 are made to encircle the terminal body 24 and thereby form the basic collar 26. The final stages of formation produce a cylindrical terminal body 24 which is closely encircled by the integral collar 26.

As better viewed in FIGS. 7 and 8, the sheet metal has been stamped to define a wall 108 of the terminal body 24 with the pair of ear means 96 extending horizontally therefrom. The opening 98 is in the middle of the wall 108 in alignment with the ear means 96 and disposed therebetween. The incision 102 in the wall 108 is provided at each edge of the ear means 96 and the extended ends 100 of the ear means 96 are curved downwardly to enable the collar 26 to be formed in close association with the previously formed terminal body 24 without altering its shape. After formation, a pair of edges 110 of the wall 108 meet at the top of the cylindrically formed terminal body 26 and define an axially extending open seam 112 of the body 26. Each ear means 96 has been bent from its base 104 at the bottom of the incisions 102 to fold back over and around that portion of the wall 108 from which it extends. The curved, extended ends 100 of both ear means 96 are inserted into the opening 98 which is on the opposite side of the terminal body 24 from open seam 112. The ear means 96 thereby combine to form the collar 26 with which retention fingers associated with a connector member can engage. Extending from the wall 108 at one end and being interlocked with the opening 98 at its other extended end 100 ensures the integrity of each ear means 96 and maintains the collar 26 in close association with the terminal body 24 and highly resilient to shear forces which would be created by the retention fingers if an attempt is made to withdraw the terminal 20 from the connector means.

FIGS. 9 and 10 show an alternative embodiment to the preferred which has, in addition to those features

of the preferred embodiment previously described, a pair of slightly longer ear means 114. The ear means 114 have been corrugated in the initial stages of formation so that having been wrapped around the terminal body 24, they combine to form a collar 26 having a height significantly greater than the thickness of the sheet metal from which it is formed.

Another alternative embodiment, shown prior to formation in FIG. 11, includes a contact terminal 116 having a terminal body 118 and a pair of ear means 120 and 122. The ear means 120 and 122 extend respectively from a pair of edges 124 and 126 of the terminal body 118 and are affixed thereto. The ear means 120 and 122 are longitudinally displaced one from the other to allow side-by-side encirclement of the terminal body 118 as a pair of extended ends 128 and 130 are inserted respectively in openings 132 and 134 in the terminal body 118. Incisions 136 provide the same function as those described hereinabove for the preferred terminal collar.

As seen in FIG. 12, in the final formation of the terminal 116, the ear means 120 and 122 bend respectively in opposite directions away from an axial seam 138 defined by the edges 124 and 126 with each completely encircling the terminal body 118. To better show the relationship of the various elements, the ear means 120 has been withdrawn from the terminal body 118. Complete formation of a collar requires the extended end 128 of the ear means 120 to be moved in the direction of arrow B and inserted in the opening 132. From this embodiment of the contact terminal 116 it is obvious that a wide variety of mating ear means could be utilized with the only requirement being that the openings in the terminal body be properly positioned to receive the extended ears of both mating ear means.

Still another alternative embodiment is shown in FIGS. 13 and 14 and includes the additional feature of having an ear means 140 which encircles a terminal body 142 in a manner which will prevent the opening of an axial seam 144 and the resulting deformation of the terminal body 142. The ear means 140 extends from an edge 146 of the terminal body 142 and has at one side of its base 148 an incision 150 and at the other side of its base 148 an opening 152. A tab 154 on an extended end 156 of the ear means 140 is adapted to be inserted in the opening 152.

For final formation the ear means 140 extends over the axial seam 144 to encircle the terminal body 142 rather than being bent away from the axial seam 144 as is the manner of formation utilized in the embodiments described hereinabove. The extended end 156 is moved in the direction of the arrow C to allow the tab 154 to be inserted into the opening 152 to form a collar which completely encircles the terminal body 142 and prevents the axial seam 144 from opening and thereby deforming the terminal body 142.

It is not intended that this invention be limited to those specific embodiments described. It is obvious that by swagging the surface of the trailing edge of the collar to provide an undercut, as shown at 56' in FIG. 4a, engagement with the retention means could be further enhanced. It is also obvious that a wide variety of fastening means might be utilized to secure the extended ends of the ear means to the terminal body to insure the integrity of the collar as it encircles the terminal body.

What is claimed is:

1. An electrical contact terminal capable of being housed in an electrical connector member having a retention means, said retention means including a resiliently deflectable retaining finger, said terminal comprising:

a stamped and formed cylindrical terminal body and annular collar;

said terminal body having an electrical wire fastening means integral with and extending from one end thereof and an axial seam extending axially thereon;

said collar being formed from ear means integral with and extending from at least one edge of said terminal body at said axial seam;

said collar coaxially encircling said cylindrical terminal body to provide a surface on its trailing edge which extends laterally of the surface of said cylindrical terminal body in close proximity therefrom; said surfaces of said edge and said body forming an angle therebetween which is less than an obtuse angle; and

said finger of said retention means capable of engaging said surface of said edge adjacent the vertex of said angle when in an undeflected position to retain said electrical contact terminal within said connector member.

2. A contact terminal as set forth in claim 1, said cylindrical terminal body having an intermediate region, said ear means extending from said terminal body in said intermediate region to provide said collar encircling said terminal body at said intermediate region.

3. A contact terminal as set forth in claim 1, said ear means being corrugated to provide said collar with a height above the cylindrical surface of said terminal body which is greater than the thickness of the stock sheet material from which said contact terminal is stamped and formed.

4. A contact terminal as set forth in claim 1, said surface being swagged at an acute angle to provide an indentation in said trailing edge of said collar with which said retention means engages.

5. A contact terminal as set forth in claim 1, said ear means extending from said edge over said axial seam and circumferentially around said terminal body, said ear means having an extended end which terminates at said edge from which said ear means extended, said collar means encircling said terminal body to prevent expansion of said axial seam.

6. A contact terminal as set forth in claim 5 including an opening in said terminal body and a locking tab means integral with and extending from said extended end, said opening being adjacent said edge of said terminal body from which said ear means extends, said locking tab extending inwardly through said opening and retaining said collar around said cylindrical terminal body.

7. An electrical contact terminal capable of being housed in an electrical connector member having a retention means comprising:

a stamped and formed cylindrical terminal body and annular collar;

said terminal body having an electrical wire fastening means integral with and extending from one end thereof and an axial seam extending axially thereon;

7

said collar being formed from ear means integral with and extending from at least one edge of said terminal body at said axial seam;

said collar coaxially encircling said cylindrical terminal body to provide a surface on its trailing edge which extends laterally of the surface of said cylindrical terminal body and with which said retention means is capable of engaging to retain said electrical contact terminal within said connector member;

said cylindrical terminal body having an intermediate region;

said ear means extending from said terminal body in said intermediate region to provide said collar encircling said terminal body at said intermediate region;

at least one opening in said terminal body;

an extended end of said ear means; and

said extended end extending inwardly through said opening and retaining said collar around said cylindrical terminal body.

8. A contact terminal as set forth in claim 7, said ear means being integral with and extending from each of said edges of said terminal body and wrapping around said terminal body away from said axial seam, said opening being in the side of said cylindrical terminal body which is opposite to the side of said axial seam on said terminal body, said extended ends of said ear means meeting at said opening and extending there-through, said ear means combining to form said collar around said terminal body.

9. A contact terminal as set forth in claim 8 including an incision in said edge of said terminal body adjacent each edge of said ear means, said ear means terminating at the base of said incisions to be wrapped therefrom around said terminal body, said ear means being circumferentially displaced from said edges to allow their meeting with minimal displacement therebetween to form said axial seam.

10. A contact terminal as set forth in claim 7 having a pair of said openings and a pair of said ear means,

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each of said ear means being wrapped circumferentially around said terminal body away from said axial seam, each of said ear means having portions which mate one to the other and overlap in side-by-side relationship on said terminal body, each of said openings adapted to receive correspondingly each said extended end of said ear means, said ear means having said mating portions combining to form said collar around said terminal body.

11. An improved circumferential collar of a type to be used on a stamped and formed electrical contact terminal having an electrical wire fastening means at one end thereof and having a cylindrical terminal body extending from said wire fastening means, said terminal body having an axially extending seam, said terminal body having said collar thereon to provide a trailing surface extending laterally of the cylindrical surface of said terminal body for cooperation with a retention means in a cavity of an electrical connector member, said improvement comprising:

a pair of ear means integral with and extending respectively from a pair of edges of said terminal body at said axial seam in an intermediate region of said terminal body;

each said ear means terminating at the base of an incision in said edge of said terminal body which is adjacent each edge of said ear means;

said ear means being wrapped from said base of said incisions circumferentially around said terminal body away from said axial seam; and

said ear means having extended ends which meet at an opening in the side of said terminal body which is opposite to the side of said axial seam and extend therethrough.

12. A contact terminal as set forth in claim 11, said ear means being corrugated to provide said collar with a height above said cylindrical surface of said terminal body which is greater than the thickness of the stock sheet material from which said contact material is stamped and formed.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,795,889 Dated March 5, 1974

Inventor(s) WARREN DAVID NAUMAN, ET. AL.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 8, Claim 12, line 39, "material", second occurrence, should read -- terminal -- .

Signed and sealed this 6th day of August 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents