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(54) **Electrical socket terminal**

Elektrischer Buchsenkontakt

Douille terminale électrique

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(56) References cited:  
**EP-A- 0 188 751**                      **EP-A- 0 254 986**  
**EP-A- 0 283 768**                      **EP-A- 0 476 848**

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## Description

The present invention relates to a high current electrical socket terminal for such uses as in automotive high current connectors.

Electrical socket terminals for use in high current connection systems, particularly for use in truck connectors are presently available to carry such high currents as are required in these applications. These contacts are however, made in the form of screw machined sockets and include a machined bore for the interconnection with the electrical insulated conductor to be terminated. Aside from the cost disadvantage of the above mentioned terminals, the socket terminals have also proven to be disadvantageous in that it is not adaptable for various wire sizes.

In the known connector, a solid brass material is machined to include either a pin and socket at one end, and a wire connecting bore at the opposite end. A wire to be terminated is first stripped and then inserted in the bore, whereupon the wire connecting portion is crushed to crimp the material forming the bore around the wire. Thus as the wire size varies the crimp quality could be affected by the increase or decrease of the void within the wire crimp area by the wire. Said differently, for given size wire crimp bore, the smaller the conductor, the more thoroughly the wire crimp area must be crushed in order to terminate the wire.

EP-A-0 254 986 discloses an electrical pin terminal and an electrical socket terminal mateable to each other and each comprising a front contact portion and a rear wire crimp portion. The front contact portion of the pin terminal is tube-shaped. Inside the tube-shaped contact portion, there is provided a tube-shaped inner spring contact including a plurality of spring contact arms inwardly directed and suspended between a forward band portion and a rearward band portion. The tube-shaped pin portion and the tube-shaped inner spring contact are dimensioned relative to each other such that there is radial and axial play between them. The socket terminal comprises a tube-shaped socket contact section, an inner contact sleeve having contact spring arms and a contact pin arranged centrally within the inner contact sleeve. There is axial play between the socket contact section and the inner contact sleeve of the socket terminal.

In the mated condition of the pin and socket terminals, there is an electric two-way contact: One electric contact between the outer surface of the pin contact of the socket terminal and the inner surface of the inner spring contact of the pin terminal, and a second electric contact between the inner surface of the inner contact sleeve of the socket terminal and the out surface of the tube-shaped pin portion of the pin terminal. Such two-way contact is required in order to allow higher electric current. For, because of the play between the tube-shaped pin section and the inner spring contact of the pin terminal on the one hand and the play between the

socket contact section and the inner contact sleeve of the socket terminal on the other hand, the electric contact of each of said two contact ways is relatively weak in view of a relatively high electrical transitional resistance. Said electrical two-way contact allowing higher electrical current is obtained by a rather complicated terminal structure only.

EP-A-0 283 768 discloses a composite female contact comprising an elastic contact element and a housing body housing the contact element. The contact element as well as the housing body are made of any metal.

A forward portion of the contact element is formed as an elastic socket section for mating with a contact pin. An intermediate locking section of the elastic contact is shaped like a pulley and the rearward end of the elastic contact has the shape of a cylindrical plug the outer diameter of which is smaller than that of the pulley-shaped locking section. The housing body comprises a cylindrical cavity for housing the socket section of the elastic contact, at a mating side of the composite contact and a cylindrical cavity at its rearward side for housing the cylindrical plug of the elastic contact. After the plug of the elastic contact is forced into the associated cavity of the housing body, the elastic contact is locked within the housing body by punching housing material into the annular groove of the pulley-shaped locking section of the elastic contact. A free end of the cavity housing the cylindrical plug is suitable for solder connection of an electric wire.

EP-A-0 188 751 discloses a connector socket for electrically connecting dual-in-line packages of integrated circuits. The connector circuit has an insulation block with a top face and a bottom face. Bores through the block have tapered inlet mouths at the top face. Metal tubular socket terminals are press-fitted in the bore portions below the tapered mouths and have pins projecting from the bottom face of the block. The socket terminals carry sleeve-shaped contact elements positioned inside each of the socket terminals for physical and electrical contact with the pins of the integrated circuit packages. The top edge of the contact element is flush with the socket top edge. The diameters at the bottom parts of the tapered inlet mouths are smaller than the diameters of the bore sections so that there is formed an abutment shoulder for the top ends of the tubular socket terminals and the contact elements. The axial length of the contact elements is smaller than that of the tubular section of the socket terminals. The abutment shoulders prevent the contact elements from being withdrawn out of the socket terminals. There is, however, no measure preventing the contact elements from being pushed towards the bottom end of the tubular section of the socket terminals, be it at the time of assembling the contact elements into the tubular sockets or be it at the time of inserting over-sized pins of an integrated circuit package.

An object of invention is to provide a more inexpensive electrical socket terminal which can also be used

with high current applications and which can be crimped to insulated conductors.

The object of the invention has been accomplished by an electrical socket terminal as defined in claim 1. Preferred embodiments thereof are defined in the dependent claims.

The invention will now be described by way of reference to the drawing figures, where;

Figure 1 is a top plan view of the subject socket terminal;

Figure 2 is a cross-sectional view through lines 2-2 of Figure 1;

Figure 3 is a top plan view of the outer socket terminal portion prior to the insertion of the inner socket portion;

Figure 4 is a cross-sectional view through lines 4-4 of Figure 3;

Figure 5 is a top plan view of the inner socket portion;

Figure 6 is a cross-sectional view through lines 6-6 of Figure 5;

Figure 7 is a diagrammatical view showing a mating pin portion which can be used to electrically connect with the socket terminal shown in Figures 1-5; and Figure 8 is a diagrammatical view of the socket terminal shown in Figures 1-6 positioned in a housing cavity.

With reference first to Figure 1, an electrical socket terminal is shown generally at 2 comprised of a front contacting section 4 an intermediate section 6 and a wire terminating section 8. As shown in Figure 2, the socket terminal 2 is comprised of an outer contact body 10 integral with the wire contacting section 8, together with an inner spring contact 12 which forms the electrical connection with the pin portion.

As best shown in Figures 3 and 4, the outer contact body 10 is stamped from a flat sheet of material and rolled into a cylindrical configuration having an axially extending seam at 14. The cylinder is held in a closed position by way of interlocking tabs 16 and 18 which prevent the radial expansion of the cylindrical body. As shown in Figure 3, the outer contact body 10 includes a constricted portion at 20 formed by a transition at 22. The outer contact body 10 further includes three raised sections 24 (only two of which are shown in Figure 3) formed by a sheared portion at 25 which forms a stop edge at 26, as shown in Figure 4. The raised sections 24 are formed to be radially equidistant with the outer diameter of the front section 11, as best shown in Figure 4. The terminal further comprises a sheared band portion 28 which is formed to be radially equidistant with the front section 11, as best shown in Figure 4, and includes a sheared edge 30 in opposing relation to the edge 26.

The outer contact member 10 further includes three raised sections 32, which as shown in Figure 4 are

formed to extend outside the radius of the cylindrical portion 11 such that a forwardly facing edge 34 extends beyond the band portions 28 for locking the terminal within a corresponding housing, as will be explained in greater detail herein. With respect still to Figure 4, the outer terminal portion 10 includes a plurality of locking fingers 36 having sheared side edges 38, the sheared edges 38 allowing the fingers to be formed inwardly towards the center line of the contact as will be described in greater detail herein. Each of the fingers 36 is formed with a peripherally extending groove 40, thereby defining a locking shoulder 42, as shown in Figure 4.

With respect now to Figures 5 and 6, the inner spring contact 12 will be described in greater detail. As shown best in Figure 5, the spring contact 12 is formed from a flat sheet of material and rolled into a generally cylindrical configuration having a longitudinal seam at 45. The spring contact 12 further includes a plurality of contact arms 46 inwardly directed at 48 to form an inner contact surface at 50. The individual contact arms 46 are generally suspended between a forward band portion 52 and a rearward band portion 54, the forward band portion 52 including a front edge at 56. The band portion 54 is integrally connected with a constricted portion 58 via a transition section 60 as best shown in Figure 5. Three raised sections generally shown at 62 are located at the transition section 60 and are raised to an outward extent equal to the outer diameter of the band portion 54 as best shown in Figure 6. The raised portion 62 is defined by a sheared portion 63 thereby forming a locking edge 64 as best shown in Figure 6. Sections 66 are located within the constricted portion and are directed inwardly as best shown in Figure 6. Finally the inner contact portion 12 includes a conical lead-in section shown generally at 70.

With the inner spring contact 12 formed as shown in Figures 5 and 6, and with the outer contact body 10 formed as shown in Figures 3 and 4, the assembly of the finished socket contact will be described in greater detail. The inner spring contact 12 is inserted with the conical lead-in portion 70 inserted through the individual fingers 36 of the cylindrical portion 11 (Figure 4). The inner spring contact 12 includes an outer surface 59 (Figure 6) on the constricted portion 58 which interferes with an inner surface 21 (Figure 4) of the constricted portion 20 and further movement of the inner socket portion 12 is by way of interference longitudinal movement between the surfaces 59 and 21. It should be appreciated that the inwardly directed portions 66 on the inner socket contact 12 can be used with an insertion tool positioned inside of the socket contact 12 for moving the spring contact 12 into its fully inserted position.

The inner spring contact 12 is inserted to a position where the edge 64 (Figure 6) abuts the forwardly facing edges 27 (Figure 4) whereby the inner spring contact is prevented from further rearward movement by way of the contact between the edges 64 and 27. When the inner spring contact 12 is in this fully loaded position,

the individual fingers 36 are crimped downwardly, radially inwardly to the position shown in Figure 2, which positions the locking edge 42 over the front edge 56 of the forward band portion 52 of the inner spring contact 12, as shown in Figure 2. As shown in Figure 1, an outer locking band 80 can now be snapped over the assembled socket contact, the band 80 being locked on the transition section 20 of the outer contact portion between edges 26 and 30 (Figure 4). The locking band 80 includes a plurality of locking lances 82 having end locking edges 84. Thus the socket terminal 2 can be locked in a connector housing such as 100, shown in Figure 8, with the socket terminal locked about a inner peripheral ring 102 by way of the locking lances 82 and the outward directed portions 32.

Advantageously then, the socket terminal can be formed with a wire insulation crimping portion 8 and yet still be used with high current applications. Advantageously the outer contact body 10 can be formed of a relatively thick material preferably a copper alloy, whereas the inner contact spring 12 can be formed from a thin material such as a copper-nickel. As the inner contact spring 12 and the outer contact body are interferringly fit between the surfaces 21 and 59, little electrical resistance is encountered between the inner socket contact and the outer contact body 10, as the assembly of the contacts cleans the surfaces 21, 59, thereby allowing the socket contact to be used in high current applications. Also advantageously, the band portions 52 and 54 are radially held in position within the outer contact body thereby providing rigidity to the inner contact spring. Finally, the individual contact arms are also provided with a rigidity in that they are suspended between surfaces 27 and 42 (Figure 4) thereby resisting the inner movement of the individual contact arms.

### Claims

1. An electrical socket terminal (2) for high current applications comprising: an outer contact body (10) having a front cylindrical section (11), an intermediate constricted portion (20) connected to said cylindrical section (11) via a transition section (22), and a rear wire connecting section (8), at least one outwardly projecting section (24) being formed adjacent the transition section (22), formed at a peripherally extending slit (25), the projecting section being formed outwardly to form an inner forwardly facing edge (27) and an outer rearwardly facing edge (26), an inner contact spring (12) comprising a plurality of individual contact arms (46) suspended between a forward (52) and rearward (54) band portion, the rear band portion being connected to a constricted portion (58) via a transition section (60), the transition section including at least one outwardly projecting section (62) thereby forming an engaging edge (64), the inner contact spring (12) being insert-

ed within said outer contact body, such that said at least one outwardly projecting section (62) engages said inner edge (27), the inner contact spring (12) being electrically connected to the outer contact body (10) by way of interference fit between the two constricted portions (20,58).

2. Electrical socket terminal (2) according to claim 1, characterized in that said outer contact body (10) is formed from a flat sheet of metal and formed into a cylindrical portion (11) having a generally axially extending seam (14).
3. Electrical socket terminal (2) according to claim 2, characterized in that said outer contact body (10) includes retaining means (36), these retaining means (36) being crimped over the front edge (56) of the inner spring contact (12).
4. An electrical socket terminal (2) according to claim 3, wherein the retaining means (36) are defined by individual locking fingers (36) which are crimped radially inwardly over the forward end of the inner contact spring (12).
5. An electrical socket terminal according to claim 4, wherein said individual fingers (36) have an inner edge (42) which locks over the front edge (56) of the inner contact spring (12) when in the crimped position.
6. An electrical socket terminal according to claim 2 to 5, characterized in that said outer contact body (10) includes interlocking means (16, 18) along said seam (14) to retain the outer contact body (10) in a closed condition.
7. An electrical socket terminal (2) according to claim 1 or 2, characterized in that the inner surface of the outer contact body (10) includes an inner edge (42) which is crimped over the front edge (56) of the inner spring contact (12).
8. An electrical socket terminal according to claim 1 to 5, wherein a peripherally extending band portion (28) is stamped outwardly from said constricted portion (20) thereby forming a forwardly facing edge (30), opposing said edge (26), and a retaining band (80) is positioned on said constricted portion (20) intermediate said edges (26,30), said retaining band (80) having a plurality of locking lances (82).

### Patentansprüche

1. Elektrische Buchsenklemme (2) für Hochstromanwendungen, die aufweist: einen äußeren Kontaktkörper (10) mit einem vorderen zylindrischen Ab-

schnitt (11), einem dazwischenliegenden verengten Abschnitt (20), der mit dem zylindrischen Abschnitt (11) über einen Übergangsabschnitt (22) verbunden ist, und einem hinteren Drahtverbindungsabschnitt (8), wobei mindestens ein nach außen vorstehender Abschnitt (24) angrenzend an den Übergangsabschnitt (22) gebildet wird, der an einem sich peripher erstreckenden Schlitz (25) gebildet wird, wobei der Vorsprungsabschnitt nach außen gebildet wird, um eine innere nach vorn gerichtete Kante (27) und eine äußere nach hinten gerichtete Kante (26) zu bilden, eine innere Kontaktfeder (12), die eine Vielzahl von einzelnen Kontaktarmen (46) aufweist, die zwischen einem vorderen (52) und hinteren (54) Bandabschnitt frei getragen werden, wobei der hintere Bandabschnitt mit einem verengten Abschnitt (58) über einen Übergangsabschnitt (60) verbunden ist, und wobei der Übergangsabschnitt mindestens einen nach außen vorstehenden Abschnitt (62) umfaßt, um dadurch eine Eingriffskante (64) zu bilden, wobei die innere Kontaktfeder (12) innerhalb des äußeren Kontaktkörpers so eingesetzt wird, daß mindestens ein nach außen vorstehender Abschnitt (62) mit der inneren Kante (27) in Eingriff kommt, und wobei die innere Kontaktfeder (12) mit dem äußeren Kontaktkörper (10) mittels der Preßpassung zwischen den zwei verengten Abschnitten (20, 58) elektrisch verbunden ist.

2. Elektrische Buchsenklemme (2) nach Anspruch 1, dadurch gekennzeichnet, daß der äußere Kontaktkörper (10) aus einem flachen Blech gebildet und zu einem zylindrischen Abschnitt (11) mit einem im allgemeinen sich axial erstreckenden Falz (14) geformt wird.
3. Elektrische Buchsenklemme (2) nach Anspruch 2, dadurch gekennzeichnet, daß der äußere Kontaktkörper (10) eine Sperreinrichtung (36) umfaßt, wobei diese Sperreinrichtung (36) über die Vorderkante (56) der inneren Kontaktfeder (12) gecrimpt ist.
4. Elektrische Buchsenklemme (2) nach Anspruch 3, bei der die Sperreinrichtung (36) durch einzelne Sperrfinger (36) definiert wird, die radial nach innen über das Vorderende der inneren Kontaktfeder (12) gecrimpt sind.
5. Elektrische Buchsenklemme nach Anspruch 4, bei der die einzelnen Finger (36) eine Innenkante (42) aufweisen, die über die Vorderkante (56) der inneren Kontaktfeder (12) verriegelt wird, wenn sie in der gecrimpten Stellung ist.
6. Elektrische Buchsenklemme nach Anspruch 2 bis 5, dadurch gekennzeichnet, daß der äußere Kontaktkörper (10) eine Verriegelungseinrichtung (16,

18) längs des Falzes (14) umfaßt, um den äußeren Kontaktkörper (10) im geschlossenen Zustand zu halten.

7. Elektrische Buchsenklemme (2) nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die innere Fläche des äußeren Kontaktkörpers (10) eine Innenkante (42) umfaßt, die über die Vorderkante (56) der inneren Kontaktfeder (12) gecrimpt ist.
8. Elektrische Buchsenklemme nach Anspruch 1 bis 5, bei der ein sich peripher erstreckender Bandabschnitt (28) aus dem verengten Abschnitt (20) heraus nach außen gestanzt ist, wodurch eine nach vorn gerichtete Kante (30), gegenüberliegend der Kante (26), gebildet wird, und bei der ein Sperrband (80) auf dem verengten Abschnitt (20) zwischen den Kanten (26, 30) angeordnet ist, wobei das Sperrband (80) eine Vielzahl von Sperrlanzen (82) aufweist.

#### Revendications

1. Borne à prise électrique (2) pour des applications à courant élevé, comprenant: un corps de contact externe (10) comportant une section cylindrique avant (11), une partie resserrée intermédiaire (20), connectée à ladite section cylindrique (11) par l'intermédiaire d'une section de transition (22), et une section de connexion des fils arrière (8), au moins une section débordant vers l'extérieur (22), agencée près de la section de transition (22), formée au niveau d'une fente à extension périphérique (25), la section débordante étant dirigée vers l'extérieur pour former un bord interne orienté vers l'avant (27) et un bord externe orienté vers l'arrière (26), un ressort de contact interne (12) comprenant plusieurs bras de contact individuels (46), suspendus entre une partie de bande avant (52) et arrière (54), la partie de bande arrière étant connectée à une partie resserrée (58) par l'intermédiaire d'une section de transition (60), la section de transition englobant au moins une section débordant vers l'extérieur (62) formant ainsi un bord d'engagement (64), le ressort de contact interne (12) étant inséré dans ledit corps de contact externe, de sorte que ladite au moins une section débordant vers l'extérieur (62) s'engage dans ledit bord interne (27), le ressort de contact interne (12) étant connecté électriquement au corps de contact externe (10) par l'intermédiaire d'un ajustement par interférence entre les deux parties resserrées (20, 58).
2. Borne à prise électrique (2) selon la revendication 1, caractérisée en ce que ledit corps de contact externe (10) est produit à partir d'une feuille de métal plate et est formé en une partie cylindrique (11)

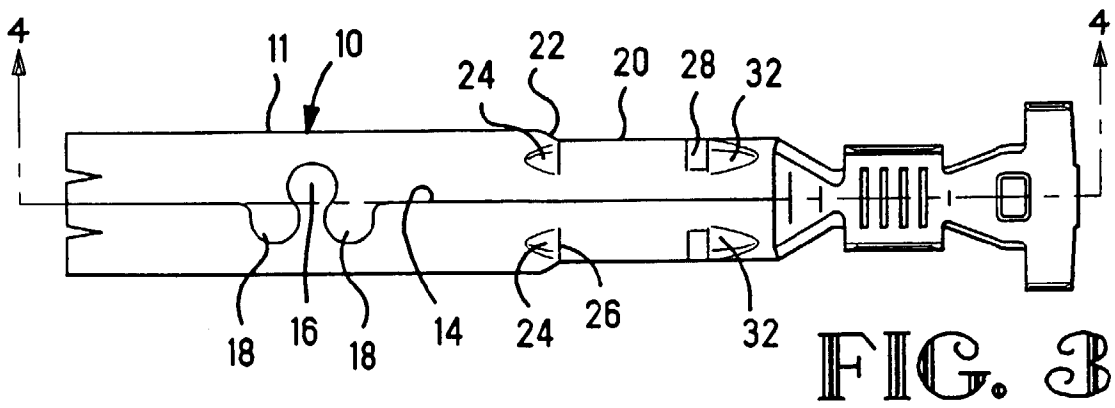
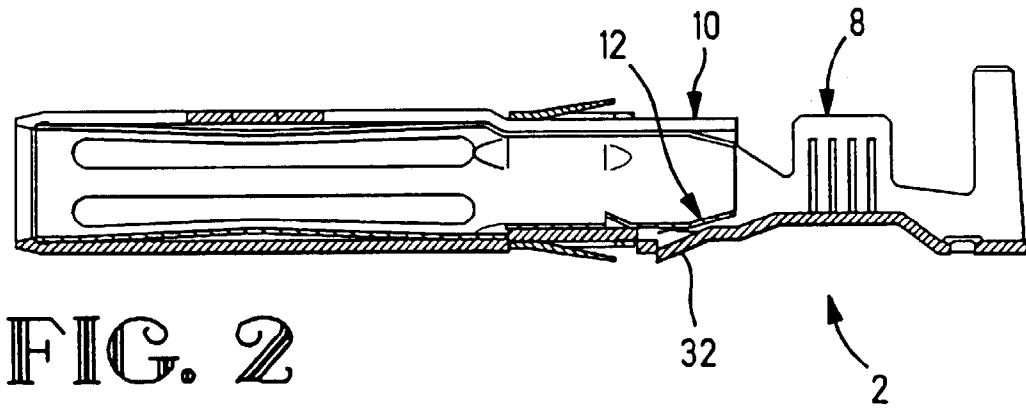
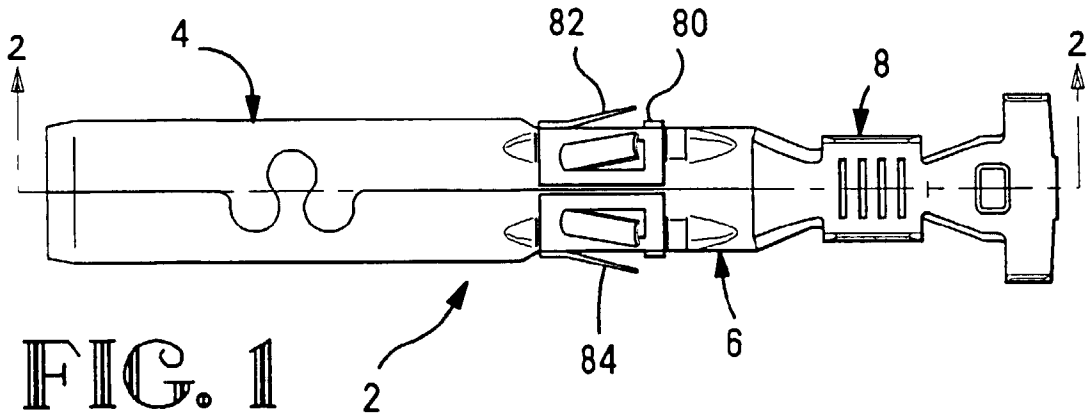
comportant une bordure à extension généralement axiale (14).

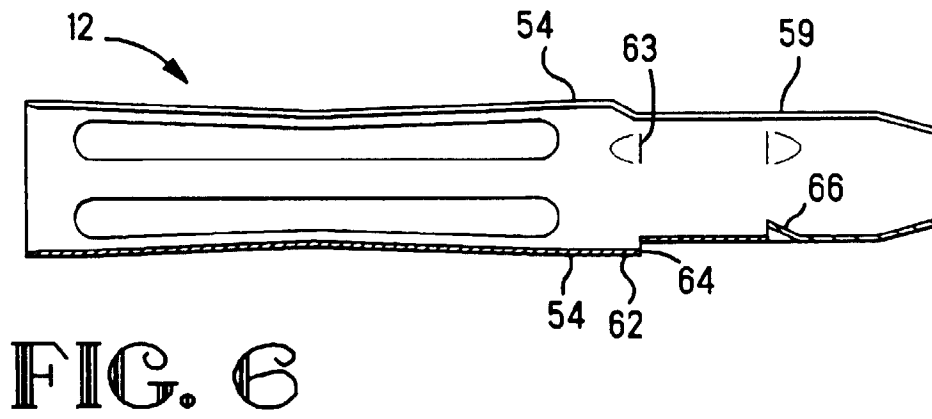
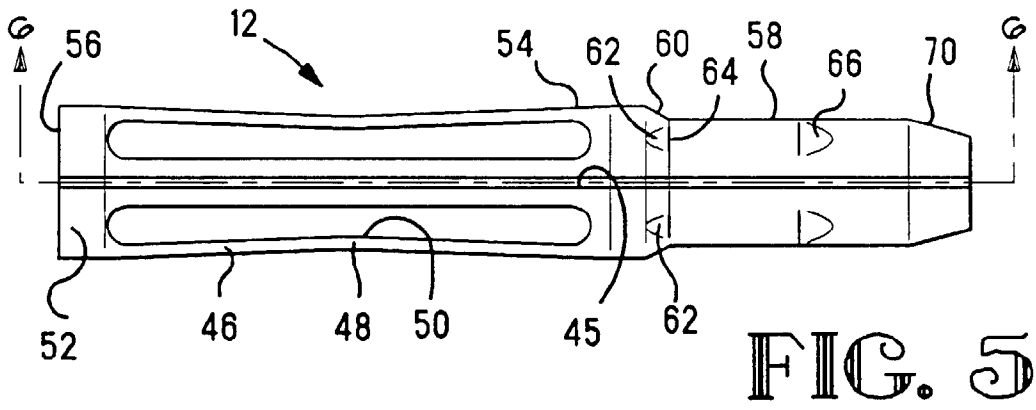
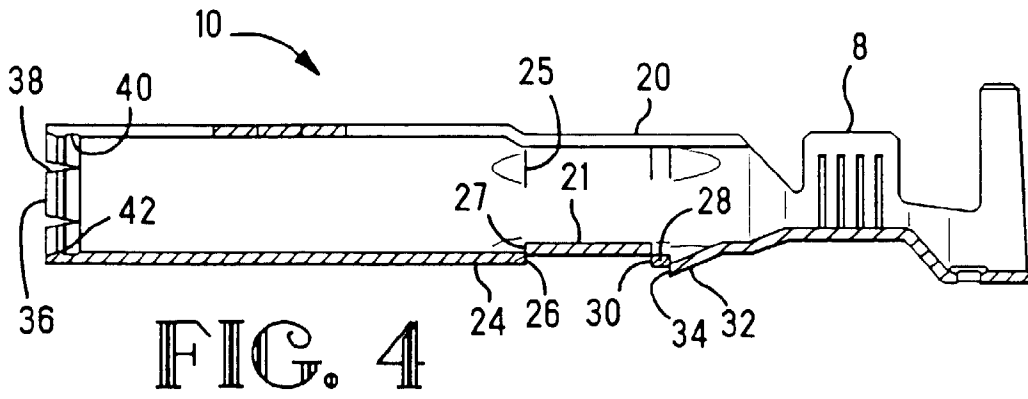
3. Borne à prise électrique (2) selon la revendication 2, caractérisée en ce que ledit corps de contact externe (10) englobe des moyens de retenue (36), ces moyens de retenue (36) étant sertis au-dessus du bord avant (56) du ressort de contact interne (12). 5
4. Borne à prise électrique (2) selon la revendication 3, dans laquelle les moyens de retenue (36) sont définis par des doigts de verrouillage individuels (36) qui sont sertis radialement vers l'intérieur au-dessus de l'extrémité avant du ressort de contact interne (12). 10  
15
5. Borne à prise électrique selon la revendication 4, dans laquelle lesdits doigts individuels (36) comportent un bord interne (42) qui est verrouillé au-dessus du bord avant (56) du ressort de contact interne (12) lorsqu'il se trouve dans la position sertie. 20
6. Borne à prise électrique selon les revendications 2 à 5, caractérisée en ce que ledit corps de contact externe (10) englobe un moyen d'interverrouillage (16, 18) le long de ladite bordure (14) pour retenir le corps de contact externe (10) dans un état fermé. 25
7. Borne à prise électrique (2) selon les revendications 1 ou 2, caractérisée en ce que la surface interne du corps de contact externe (10) englobe un bord interne (42) qui est sertie au-dessus du bord avant (56) du contact de ressort interne (12). 30
8. Borne à prise électrique selon les revendications 1 à 5, dans laquelle une partie de bande à extension périphérique (28) est estampée vers l'extérieur à partir de ladite partie resserrée (20), formant ainsi un bord orienté vers l'avant (30), opposé audit bord (26), une bande de retenue (80) étant positionnée sur ladite partie resserrée (20) entre lesdits bords (26, 30), ladite bande de retenue (80) comportant plusieurs lames de verrouillage (82). 35  
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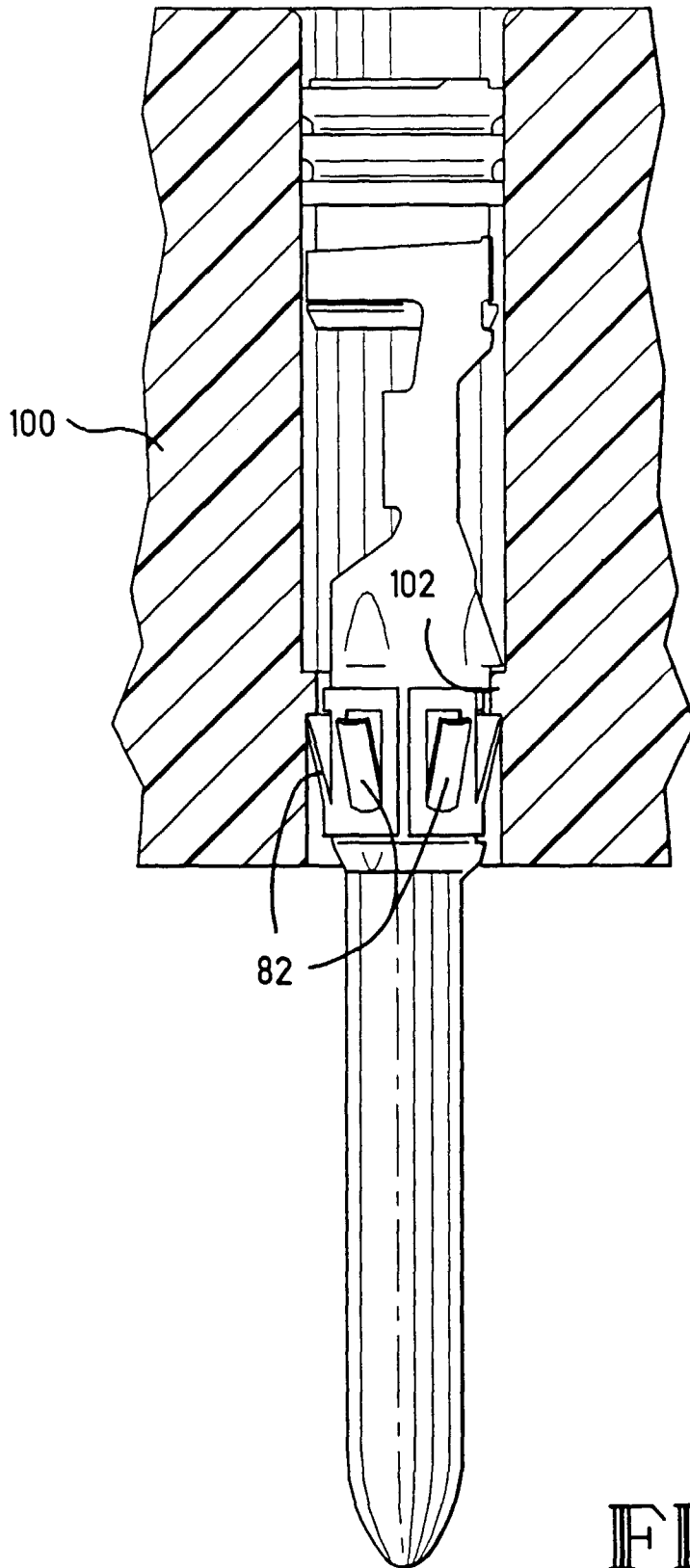


FIG. 7

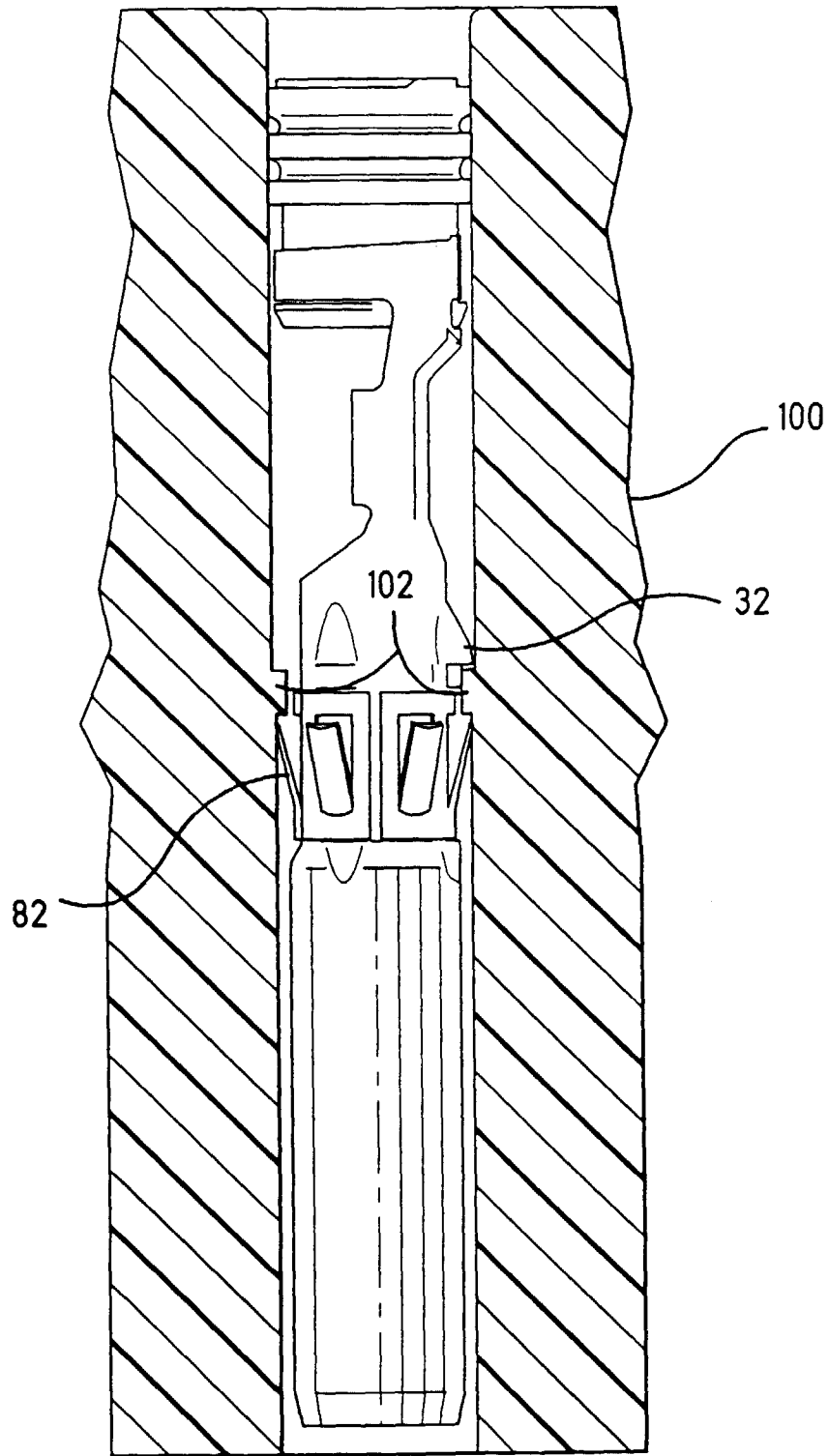


FIG. 8