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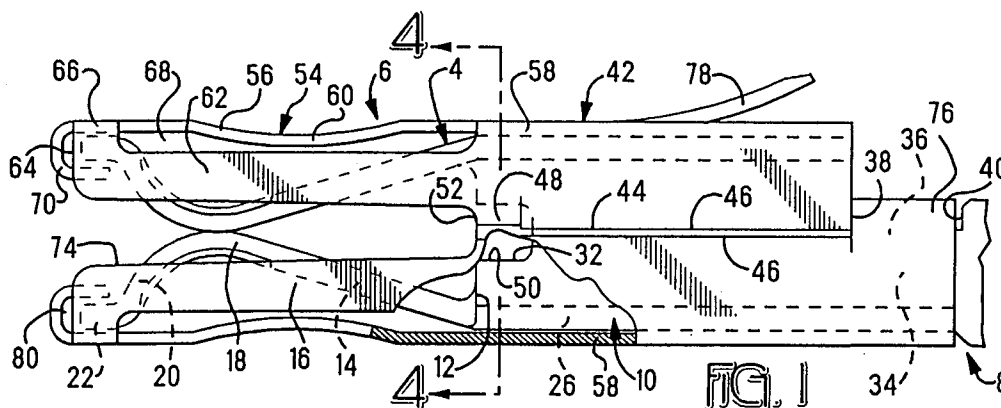
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D-80797 München (DE)(54) **Electrical terminal with outer backup spring.**

(57) An electrical receptacle terminal (2) comprises an inner contact (4) and an outer backup spring (6) disposed closely therearound. The outer backup spring has a pair of opposed spring members (54) disposed over cantilever contact arms (14) of the inner contact (4). The spring members (54) comprise a first spring arm (56) and lateral second spring-support arms (62) disposed substantially orthogonally thereto. The first and second spring arms are joined at a front end (64) by an L-shaped joining section (66), and separated by a slot (68) extending from the joining section (66) to a body section (42) of the backup spring. The second arms (62) of the spring member (54), substantially increase the

spring force of the first spring arm (54) against which the inner contact arms (14) are biased during insertion of a complementary male tab therebetween. The spring force of the inner contact arms (14) are further increased by providing a U-shaped tab (70) folded over free end tips (22) of the contact arms to limit sliding movement thereof. The joining section (66) at the front end of the backup spring is aligned with the box-shaped body section (42) and reduces rocking of the terminal when inserted into a corresponding cavity of a connector housing. Furthermore, the inner contact body is well protected from external objects.

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This invention relates to an electrical receptacle terminal having an inner contact with cantilever contact arms, and an outer backup spring having spring arms for increasing the spring force of the cantilever contact arms whereby the spring arms comprise a first arms and a second arms perpendicular thereto for increasing the spring force thereof.

There is an increasing demand in the electrical industry to produce compact and robust terminals having small material cross-sections, yet carry high electrical currents whilst remaining reliable. Some of the important factors determining the current carrying capability of a terminal is the conductivity of the metal from which the contact is formed, and the contact resistance between mating terminals which is largely determined by the contact pressure exerted therebetween - which in turn is determined by the spring forces that engage the contact surfaces together. Unfortunately, the sheet metal commonly used for producing electrical terminals usually decreases in resiliency as the conductivity and ductility increases. For this reason, terminals have been provided with a backup spring of resilient temperature resistant material such as steel, that provides added resilient forces stable over time and at operating temperature. There is however a need to further increase the spring force of the backup spring while making the terminal as compact as possible.

As most electrical terminals are mounted within connector housings, the outer backup spring should also provide an outer support surface that allows the terminals to be easily inserted and snugly held within corresponding terminal receiving cavities of the housing.

It is therefore an object of this invention to provide a compact and robust electrical receptacle terminal for electrical connection to a complementary male tab terminal, whereby the terminal provides high contact pressure therebetween and is reliable.

A further object of this invention is to provide a compact terminal with high contact pressure that has an outer geometry well adapted for easy insertion and snug fitting within a corresponding terminal receiving cavity of an electrical connector housing.

The objects of this invention have been achieved by providing an electrical receptacle terminal comprising an inner contact body with opposed cantilever contact arms and an outer backup spring having a box-shaped body disposed closely around a body section of the inner contact, the outer backup spring having opposing spring members extending therefrom over the cantilever contact arms whereby each spring member comprises a first spring arm and a second spring support arm

in a plane approximately perpendicular to the first spring arm, the first and second arms joined at free ends proximate tip sections of the inner contact arms. The inner contact tip sections are biased against the spring members and resiliently supported thereby during insertion of a complementary male tab between the contact sections whereby the right angled disposition of the first and second spring arms greatly increases the spring strength thereof. The substantially box-shaped profile generated by the right angled spring members and box-shaped body section of the outer backup spring, not only protect the inner cantilever contact arms from damage, but enable snug and easy insertion of the terminal in a cavity of an electrical connector housing.

The preferred embodiment of this invention will now be described in more detail with reference to the drawing figures, whereby;

Figure 1 is a bottom view of the preferred embodiment of this invention;

Figure 2 is a side view of the embodiment shown in Figure 1;

Figure 3 is a cross-sectional view through lines 3-3 of Figure 2; and

Figure 4 is a detailed partial view of a seam of the outer backup spring as seen in the direction of arrow 4 of Figure 2.

Referring to Figures 1 to 4, an electrical receptacle terminal generally shown at 2 comprises an inner contact 4 and an outer backup spring 6, the inner contact comprising a conducting wire connection section 8 (only a small part of which is shown) extending into a box-shaped body section 10 having a front end 12 from which extend a pair of opposed cantilever contact arms 14. The contact arms 14 comprise successively, converging sections 16, extending into a contact section 18 where the contact arms touch each other, then extending into an outwardly flared tip section 20 having tips 22 at free ends thereof. The tips 22 are substantially parallel to the mating direction of a complementary male tab terminal with the receptacle terminal 2.

The inner contact 4 is stamped and formed from sheet metal, whereby the box-shaped body section 10 therefore has a seam 24 (see Figure 3) resulting from the folding together thereof. The body section 10 has a pair of opposed side walls 26 from which the contact arms 14 extend, a top wall 28 and opposed bottom wall 30, both orthogonal to the side walls 26. The bottom wall 30 comprises a centrally disposed U-shaped slot 32 extending from the front end 12 of the body section.

Between the body section 10 and conducting wire receiving section 8 of the inner contact 4, is a U-shaped mounting portion 34 comprising longitudi-

dinal upper edges 36 flanked by orthogonal forward and rearward edges 38, 40. The wire connecting section 8 can be provided with any known wire connecting device such as a crimping barrel, or insulation displacement contact and is therefore not shown or described herein.

The outer backup spring 6 comprises a box-shaped body section 42 disposed closely around the inner contact body section 10 and comprising a seam 44 formed by edges 46 resulting from the stamping and forming process thereof. The body section 42 further comprises a pair of deformed tabs 48 clinched over opposed edges 50 of the inner contact body slot 32. Extending from a front end 52 of the backup spring body section 42, are a pair of opposed spring members 54 disposed over the inner contact arms 14.

The spring members 54 comprise a first spring arm 56 extending from side walls 56 of the outer backup spring body section 42, the side walls 58 being contiguous with the inner contact side walls 26, whereby the first spring arms 56 extend in a plane roughly parallel to the side walls 58 and 26, except for a slightly concave mid-section 60. Each spring member 54 further comprises a pair of second spring support members 62 that flank lateral sides of the first arm 56 and are approximately perpendicular thereto. The first and second arms 54, 62 are joined at forward free ends 64 by L-shaped joining sections 66, and separated by a slot 68 extending from the joining section 66 to the body section front end 52. From the forward free end 64 of the first arm 54, further extends a tab 70 folded in a U-shape over the tips 22 of the inner contact arms 14, whereby the contact tips 22 are slidably held between the front end of the first arm 54 and the tab 70 and spaced longitudinally therefrom by certain amount of play (80).

The second spring support arms 62 are also bent slightly inwards towards a mid-section 72 and opposing second arms 62 of opposing spring members 54 are separated by a slot 74 extending from the front end 64 to the body section front end 52.

Secure fastening of the outer backup spring to the inner contact is effectuated by clinching tabs 76, at a rear end of the body section, over the edges 36 of the inner contact body mounting section 34, whereby the forward and rear edges 38, 40 thereof immobilize longitudinal movement of the backup spring 6 with respect to the inner contact 4.

A locking lance 78 projects obliquely outwardly and rearwardly from a side wall 58 of the outer backup spring for locking the terminal 2 in a cavity of an electrical connector housing.

A complementary male tab for electrical connection to the receptacle terminal 2, is initially guided during insertion by the forward U-shaped

tabs 70 and then by the outwardly flared tip sections 20 of the contact arms 14. Further insertion of the tab between the contact sections 18 resiliently biases the contact arms outwards and urges the tips 22 against the outer backup spring first arms 56 which are thereby also resiliently biased outwards. The contact tips 22 are held with a certain amount of longitudinal play 80 allowing them to slide, with respect to the outer backup spring, a small amount in the longitudinal (or mating) direction. The latter increases the flexibility of the contact arms 14 during the initial stages of insertion of the male tab between the contact portions 18 so as to reduce the insertion force thereof.

The insertion force is the greatest during the initial stages of prising apart the contacts 18 by the leading edge of the male tab (which usually comprises a taper). By allowing a certain amount of sliding of the contact arm tips 22 with respect to the outer backup spring, the contact arms 14 are able to "straighten out" a small amount during prising apart of the contacts 18 thereby having only bending moments within the contact arms and eliminating compressive forces that would occur if the tips 22 were rigidly attached to the outer backup spring. As the leading edge of the male tab is further inserted between the contacts 18, the contact arm tips 22 butt against the U-shaped tabs 70, thereby rendering the contact arms 14 more rigid with respect to the prising-apart forces at the contact sections 18. A large part of the spring forces are provided by the outer spring members 54, whereby the second support arms 62 substantially increase the spring force due to its disposition essentially within the plane of bending. The tabs 48 clinched to the slot 32 of the inner contact prevent the spring forces opening the outer backup spring seam 44, thereby ensuring a high spring force of the spring members 54. A slot 68 is provided between the first 56 and second 62 arms to ensure that the spring members 54 remain adequately flexible for the outward resilient biasing thereof when the male tab is inserted.

In addition to the high spring force provided by the spring members 54, the right angled disposition of the first and second arms 56, 62 substantially encloses the cantilever contact arms 14, thereby providing protection thereof from external objects that may snag onto, or otherwise damage the contact arms. Additionally, the L-shaped joining sections 66 at the front end 64 of the backup spring are aligned with corners of the box-shaped profile of the body section 42, thereby providing a stable positioning of the terminal 2 in a box-shaped housing cavity, whereby the relatively long distance between the body section 42 and front end 64 reduces pivoting of the terminal 2 within the cavity.

Advantageously therefore, the outer backup spring confers a high spring force yet sufficient flexibility to the contact arms 14. Limited sliding of the contact arm tips against the outer backup spring, ensures great spring strength of the inner contact arms yet a reasonably low insertion force. Furthermore, the inner contact arms 14 are substantially enclosed on all sides by the first and second spring arms and the front U-shaped tab, thereby protecting the inner contact from damage. Another advantage is procured from the front end profile resulting from the first and second spring arms which is aligned with the box-shaped body section, thereby providing stability in the positioning of the terminal within a housing cavity.

Claims

1. An electrical receptacle terminal (2) stamped and formed from sheet metal, comprising an inner contact body (4) and an outer back-up spring (6), the inner contact body (4) comprising a box-shaped body section (10) and a pair of opposed cantilever contact arms (14) extending from opposed side walls (26) of the body section (10) and successively comprising converging sections (16), contact sections (18) and outwardly flared tip sections (20), the outer back-up spring (6) comprising a box-shaped body section (42) disposed closely around the inner contact body section (10), and opposing spring members (54) extending longitudinally therefrom over the inner contact arms (14), characterized in that each spring member (54) comprises a first spring arm (56) extending in a plane parallel or slightly angled to the inner contact body side walls (26), and a second spring support arm (62) extending approximately in a plane perpendicular thereto, the first and second arms joined by an L-shaped joining section (66) at free ends (64) proximate the contact tip sections (20), whereby the contact tip sections (20) are biased against the spring members (54) and resiliently supported thereby during insertion of a complementary male tab between the contact sections (18).
2. The electrical terminal of claim 1 characterized in that the contact tip section (20) comprises a tip (22) at its free end over which is folded a U-shaped tab (70) of the spring member (54) extending from the front free end (64) of the first arm (56).
3. The terminal of claim 2 characterized in that the tab (70) of the first arm (56) is folded over the tip (22) by substantially 180°.
4. The terminal of claims 2 or 3 characterized in that a certain amount of longitudinal play (80) is provided between the tip (22) and U-shaped tab (70) to allow limited longitudinal sliding movement therebetween.
5. The terminal of any of claims 1-4 characterized in that the first (56) and second (62) arms are separated by a slot (68) extending from the L-shaped joining section (66) to a position proximate the inner contact body section (10).
6. The terminal of any of claims 1-5 characterized in that the second arms (62) of opposing spring members (54) are separated by a slot (74) extending from a position proximate the inner contact body section (10) to the free ends (64).
7. The terminal of any preceding claim characterized in that the body section (42) of the outer back-up spring (6) comprises a seam (44) resulting from folding together edges (46) thereof, and a pair of tabs (52) clasped to opposed edges of a slot (32) in a wall (30) of the inner contact body section (10) adjacent the seam (44) for holding the seam edges (46) together.
8. The terminal of claim 7 characterized in that the pair of tabs (52) are adjacent the slot (74) that separates the second arms (62).

