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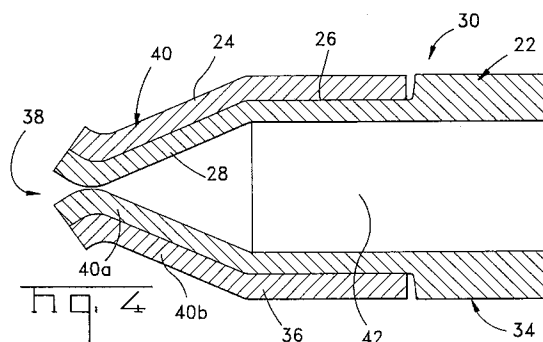
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(57) An electrical terminal (30) is formed of a composite of materials where a conductive metal (22) has a laminated portion (24) thereon. The conductive metal (22) has a recessed section (26) which receives a spring metal (24) laminated therein, such the composite thickness of the laminated layer is uniform with the remainder of the contact. An electrical terminal can then be stamped and formed from the composite material, such that (36) is formed in the area carrying the laminated layer of the spring metal (24).

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The subject invention relates to an improved electrical terminal and a method of making the same, and in particular terminals having increased contact force added by an additional back-up spring.

It is known to have electrical terminals which include an inner contact portion having opposed contact arms formed by cantilever beams, where a back-up spring or an assist spring is included having back-up spring arms which increase the contact force on the opposed contact arms for increasing the contact pressure to a mating tab terminal. In these known electrical contacts, manufacturing is made difficult by the inclusion of the separate outer back-up spring as the back-up spring must be assembled around the inner contact member. Normally, the back-up spring is partially assembled and positioned around the inner contact and then finally assembled to the inner contact member. In that these contacts are relatively small, the terminals are generally kept on strip form, while the back-up springs are formed on a separate strip and positioned over the inner contact portions and later formed around the inner contact. This provides a difficult assembly process and furthermore requires the usage of two separate stamping dies to stamp out the separate parts which adds to the total cost of individual components parts.

It is therefore an object of the present invention to provide a simplified method of manufacturing an electrical terminal as described above.

It is a further object of the invention to provide an electrical terminal which is more cost effective to manufacture.

The objects of the invention have been accomplished by providing a method of producing an electrical terminal comprising the steps of laminating two materials together and stamping and forming the laminated combination into an electrical terminal.

A preferred embodiment of the invention will be described by way of reference to the drawing figures where;

Figure 1 is an isometric view of a prior art contact;

Figure 2 is an isometric view of a strip of material formed according to the present invention which can be used to stamp electrical terminals therein;

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

Figure 4 shows a cross-sectional view through an electrical terminal stamped and formed according to the teaching of the present invention;

Figure 5 is a cross-sectional view through an alternative embodiment of the invention; and

Figure 6 is an isometric view of the strip material used to form the terminal of Figure 5.

With respect first to Figure 1, a prior art electrical terminal is shown at 2 which includes an inner contact member 4 and an outer assist spring 6. The inner contact member is comprised of a forward contact section 8 comprised of opposed cantilever beam spring arms 10 which form opposed contacts for receipt of a tab terminal therebetween. The spring arms 10 extend forwardly from a central section of the terminal 12 at one end, and at the opposite end a wire connecting crimp section 14 extends therefrom. It is also typical to stamp and form the contact member 4 to its complete configuration, but leave the outer back-up spring 6 to a position where the side walls 16 of the back-up spring are slightly open such that the back-up spring 6 can be received over the inner contact member 4. When the assist spring 6 is fully seated over the contact member 4, sections 18 can be crimped around the contact arms 10 to retain the back-up spring 6 to the inner contact member 4.

In the terminal of Figure 1, the inner contact member 4 is usually comprised of a copper alloy, such as beryllium-copper, whereas the outer back-up spring 6 is comprised of a spring steel such as stainless steel. The terminal shown in Figure 1 is referred to as applicants "Junior Power Timer" where, in order to provide for the electrical conductivity required, the thickness of the base material of beryllium-copper used to stamp and form the inner contact member 4 is 0.32mm in thickness. The conductivity of beryllium-copper alloy is 28 IACS, which is a ratio of the conductivity to pure electrolytic copper, having a base of 100.

With respect now to Figures 2 and 3, a new material is formed at 20 which is a lamination of materials 22 and 24, where material 22 is pure electrolytic copper, whereas the material 24 is a stainless steel. In the preferred embodiment of the invention, a stepped portion of the copper is formed, for example by rolling the material along direction of arrow C in Figure 2, to provide a reduced cross-section of thickness such as b, where $b = 0.12\text{mm}$ in thickness. It should be appreciated that the conductivity of the reduced thickness portion at 28 will be equal to or greater than the conductivity of beryllium-copper having a thickness of 0.32mm. Further, in the preferred embodiment of the invention, a thin strip of stainless steel 24 is laminated, for example by give, or other means, to the strip of material 22, in the reduced thickness section 26, to form a uniform thickness material where $a = 0.20\text{mm}$, such that the entire thickness is once again 0.32mm.

With the laminated material 20 as shown in Figure 2 and 3, an electrical contact can be stamped and formed therefrom to any desired configuration, and as shown in Figure 4, a terminal is shown at 30 having an inner contact portion 34 and

a laminar portion at 36 which forms a contact receiving section at 38. Opposed contact portions 40 are formed by a lamination of the reduced thickness portion 28 and by the stainless steel sheet 24. It should be appreciated that the laminar sheet 20 could be so provided so that the stainless steel outer layer 24 extends along any length of the electrical terminal to provide for various configurations of electrical terminals. It should also be appreciated that if desirable, the outer laminated layer 24 could extend the entire length of the terminal to include the wire crimp section at 14. However as shown in Figure 4, the laminar layer 24 only encompasses the opposed contact spring arms 40a and a portion of the central section 42 of the inner contact.

With respect now to Figures 5 and 6, a second embodiment of the invention will be shown which provides a terminal at 120 having similar laminations of copper 122 and stainless steel 124 where contact arms 140 are formed as shown in phantom in Figure 6 and are folded back from a front leading edge 141 such that the assist spring 136 is positioned inside of the contact arms as shown in Figure 5.

Advantageously, the laminated material provides a much simpler method of forming the contact, as no assembly of inner spring contact and outer back-up spring is required. Furthermore the entire stamping and forming operations is done with one set of dies, thereby reducing the overall cost of the assembly equipment.

Claims

1. A method of producing an electrical terminal (30,120) comprising the steps of:
laminating two materials (22, 24) together;
and
stamping and forming the laminated combination (20) into an electrical terminal (30, 120).
2. The method of claim 1, wherein the two materials comprise a highly conductive material (22) and a spring metal (24).
3. The method of either of claims 1 or 2, wherein the spring metal portion (24, 124) forms an assist spring (40b, 136) for contact arms (40a, 140) formed by the stamping.
4. The method of any of the preceding claims, wherein the conductive material is formed with a reduced thickness area (26) along a portion of its length, and the spring metal (24) is laminated against the reduced thickness area (26).

5. Electrical terminal having a contact section (8) comprising cantilever beam spring arms (10) which form opposed contacts for receipt of a tab terminal therebetween, characterized in that at least a part of each spring arm (10) comprises two laminated layers, one of the layers being of a highly conductive material (22) and the other layer being of a spring metal (24).

