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ELECTRICAL CONNECTORS

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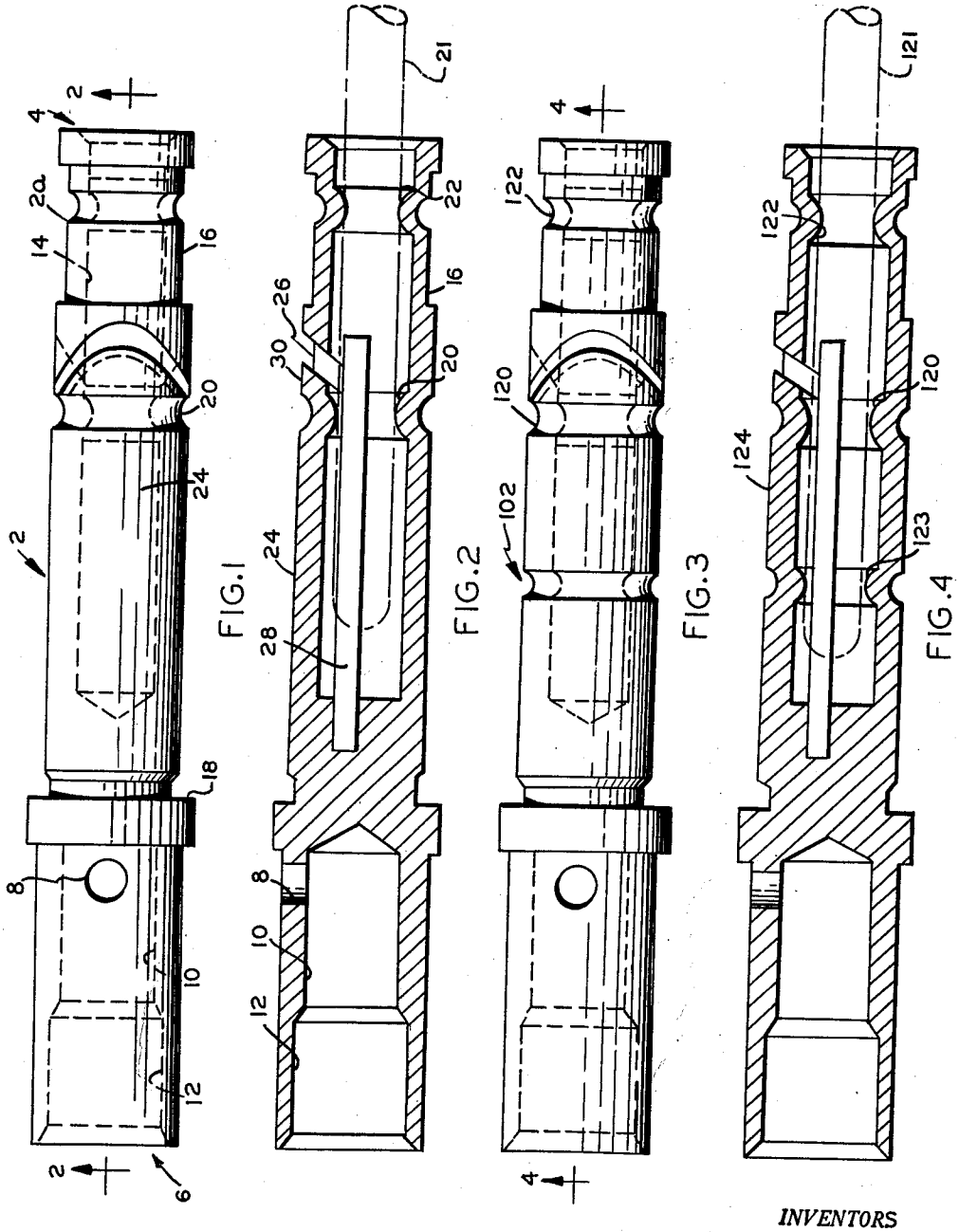

FIG.1 FIG.2 FIG.3 FIG.4

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ELECTRICAL CONNECTORS

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This invention relates to electrical connectors, and more particularly, to socket contacts for pin and socket type connectors.

Pin and socket type connectors are well known in the prior art, and are to be found in various shapes and configurations. The rudimentary connector consists of a smooth, uniform diameter pin which is inserted into a mating, smooth, uniform diameter socket. Good electrical contact therebetween is dependent on a tight frictional fit between the pin and socket. Since close manufacturing tolerances are difficult to obtain, it has become customary to make either the pin or the socket of resilient construction. While such an arrangement is practical, there is generally no definite, specific and invariable point of good electrical contact between the contacts. Rather there is a large intersurface area in which, depending on the exact surface configuration produced by the vagaries of manufacture, electrical contact might somewhere be made. This results in a variable and often high contact resistance between the pin and the socket.

A common resilient socket variant is a tubular socket having an unbroken periphery at its pin receiving end, and a leaf spring formed out of a part of said socket wall by means of a transverse and then longitudinal saw cut. The leaf is then set so that it depends towards the center of the socket. When the pin is inserted into the socket it biases the leaf outwardly and is pressed thereby against the wall of the socket opposite the leaf.

Another common resilient socket variant is a tubular socket which is slit longitudinally at its pin receiving end to provide a plurality of resilient fingers. The fingers are biased towards the center of the socket. When the pin is inserted into the socket it biases the fingers outwardly, the fingers thereby gripping the pin.

The leaf spring socket has a major advantage over the split finger socket. An oversize pin or probe may be inserted into a split finger socket, spreading apart and permanently distorting the fingers. The leaf spring socket has an unbroken periphery at its end which naturally prevents the entry of a grossly overdiameter pin, and thereby prevents permanent distortion of its leaf spring. This feature is commonly known as "closed-entry." A recent improvement to the split finger socket has been to provide an end cap or "closed entry adapter" which fits over the ends of the split fingers and has a central bore with an unbroken periphery. This adapter both limits the diameter of the pin which may be inserted therethrough, and the spreading out of the ends of the split fingers.

To establish a definite and invariable contact area between the pin and the socket, an improvement has become known in the split finger type socket of providing a roll or bead on the inner wall of the ends of the split fingers. The pin always makes contact with the fingers at this bead. By controlling the resiliency of the fingers and thus the force applied to the pin, and the width of the bead, a substantially uniform and fixed contact area and resistance can be obtained. Since the contact area is provided by the relatively small area of the bead, rather than the total area of the socket, for a given force relatively high contact pressure can be obtained. These high contact pressures are useful in breaking down any coatings which might develop on the surface of the pin, and in providing a low contact resistance. This bead, however, raises a disadvantage. The pin effectively contacts the

socket at the bead, and since the rest of the socket is of larger diameter than the bead, the pin has a tendency to wiggle in the socket.

If the above described contact bead of the split finger socket is directly incorporated into the leaf spring socket to obtain the advantage of a fixed contact area high pressure and low resistance, a disadvantage results. The inner diameter of the bead must be substantially that of the pin. Therefore, the inner diameter of the rest of the socket must be significantly greater than the pin. An obvious expedient would be to provide a separate closed entry adapter over the end of the socket to reduce the entrance diameter of the socket bore. This requires a separate part and an additional assembly operation. Another expedient would be to flange inwardly the end of the socket. This requires an independent manufacturing operation and often produces a burr which would scrape the surface of the pin as it is inserted.

It should be noted that the sawing operation in both the leaf spring and the split finger sockets produces a burr. This burr in the prior art devices interfered with the inserted pin and had to be removed.

It is, therefore, an object of this invention to provide a leaf spring socket having a contact bead, and an integral closed entry feature.

Another object is to provide the abovementioned socket with its contact bead and integral closed entry feature in substantially the same manufacturing operation.

Still another object is to provide the abovementioned socket with an integral closed entry feature which has no burr which will interfere with an inserted pin.

Yet another object is to provide the abovementioned socket with an independent pin cleaning pressure means, and an independent pin contacting pressure means.

A feature of this invention is a leaf spring socket having a first internal annular bead on the end of its spring and adjacent socket and a second annular bead between the end of the socket and the end of the leaf spring.

These and other objects and features of this invention will become more apparent by reference to the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a top view of a spring leaf socket embodying this invention;

FIG. 2 is a front view in cross-section of the socket of FIG. 1;

FIG. 3 is a top view of second embodiment of this invention; and

FIG. 4 is a front view in cross-section of the embodiment of FIG. 3.

Referring to FIGS. 1 and 2, a spring leaf socket type contact **2** is shown having a pin receiving socket **4** and a conductor receiving socket **6**. The conductor receiving socket may include a peep-hole **8**, a conductor socket **10** and an insulation shroud **12**. The conductor (not shown) may be secured to the socket by any suitable means, e.g. crimping or soldering.

The pin receiving socket **4** has a bore **14** and may have a necked portion **16** adapted to receive a locking spring (not shown) to cooperate with contact shoulder **18** in locking the contact into its housing (not shown). A first annular bead **20** is rolled into the socket periphery to provide a fixed and relatively small pin-contacting area. The inner diameter of this bead is substantially equal to the diameter of the contact pin **21** (shown in dot-dash lines in FIGURE 2) which the socket is to receive. A second annular bead **22** is rolled into the socket periphery adjacent the end of the socket. The inner diameter of this bead is also substantially equal to the diameter of the contact pin; and provides the closed entry feature and, if desired, a second relatively small pin-contacting area. A pin or probe greater than the inner diameter of the sec-

ond bead can not be forced beyond this unbroken peripherial bead into the socket.

The spring leaf **24** of the socket is formed by transverse **26** and longitudinal **28** saw cuts into the medial portion of the socket. The free end **30** of the leaf may be given a permanent set towards the center of the bore.

The two rolls provide smooth, burr free surfaces to contact the inserted contact pin without damage thereto. A burr caused by the sawing of the spring leaf or cutting the end of the socket will be spaced away from the contact pin. If it is desired, these burrs may be removed by a suitable electro-chemical treamtent.

It will be seen that the second bead **22** besides providing the closed entry feature, may be formed to a diameter equal to that of the inserted pin. The roll will then apply a high pressure to the pin as it is inserted, cleaning the surface of the pin as it passes thereunder. The first bead **20** will provide a high pressure, small area contact to the pin, ensuring a uniform, low resistance contact therewith.

A second embodiment of the invention is shown in FIGS. 3 and 4. The leaf spring socket contact **102** has a first annular bead **120** having an inner diameter less than the diameter of the contact pin **121** (shown in dot dash lines in FIGURE 4) to be inserted. A second annular bead **122** having an inner diameter substantially equal to the contact pin is formed at the socket end to provide the closed entry feature. A third annular bead **123** having an inner diameter substantially equal to the contact pin is formed in the socket proximal the fixed end of the leaf. The leaf **124** is cut out of the socket wall and set towards the bore. This provides a three point longitudinal contact between the portion of the first bead on the free end of the leaf, and the opposed areas of the second and third beads, avoiding any wiggle of the pin in the socket.

The invention has thus been described, but it is desired to be understood that it is not confined to the particular forms or usages shown and described, the same being merely illustrative, and that the invention may be carried out in other ways without departing from the spirit of the invention, and, therefore, the right is broadly claimed to employ all equivalent instrumentalities coming within the scope of the appendent claims, and by means of which objects of this invention are attained and new

results accomplished, as it is obvious that the particular embodiments herein shown and described are only some of the many that can be employed to obtain these objects and accomplish these results.

We claim:

1. A connector comprising a socket contact and a mating pin contact having a given diameter; said socket having a bore of diameter greater than said given diameter including an open end adapted to receive said pin contact; said bore including an unbroken annulus located substantially at the bore open end, and a longitudinally disposed leaf spring formed into and from a portion of the wall of said socket and depending into substantially the medial length of said bore; a first internal annular bead formed in a section of said bore including said unbroken annulus; a second internal annular bead formed in a section of said bore including said leaf spring; the inner diameter of said first and second beads being substantially equal to the diameter of said pin contact.

2. A connector according to claim 1 further including a third annular bead in said bore longitudinally spaced from said second bead on the side thereof remote from said first bead.

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