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COPYSPECIFICATIONSHUNT CONNECTOR ASSEMBLY① Original spec
31-8-95
② Replacement
sheet 18.3-96Field of the Invention

5 The present invention relates generally to a shunt connector assembly for electrically shorting adjacent contact posts on a printed circuit board. More specifically, the invention relates to a low profile miniaturized shunt connector assembly which maintains sufficient retention force between adjacent post contacts and the shunt assembly terminals.

Background of the Invention

10 As miniaturization of electronic equipment and associated printed circuit boards continues, there is an increasing demand for corresponding low profile connector assemblies for mounting on the printed circuit boards. Space and density become so valuable that even a small two
15 circuit shunt connector assembly for electrically shorting an adjacent pair of post contacts must be down-sized or miniaturized, along with the down-sizing of the printed circuit board. To miniaturize a typical connector assembly, there must be a reduction in the overall height
20 of the housing and a corresponding reduction in the height of a terminal which consequently reduces the effective beam length of the contact arms of the terminal. This, in turn, results in a decreased amount of resilient deformation of the contact which may cause plastic deformation in the
25 housing portion in engagement with the post contact. Therefore, such a miniaturization could potentially cause instability in the electrical connector. Furthermore, in the miniaturization of a shunt connector assembly, since such a connector is designed to resiliently couple two
30 adjacent post contacts and maintain engagement by way of frictional forces, when the shunt connector assembly is miniaturized, the frictional or engagement forces become



smaller due to the shortening of the effective beam length of the contact arm therefore making it difficult to maintain sufficient retention force between the post contact and the shunt connector assembly terminals and compromising the mechanical and electrical interconnection therebetween.

Figure 11 shows a shunt connector assembly as disclosed in Japanese Unexamined Utility Model Publication (Kokai) No. Heisei 5-62994.

As shown in Fig. 11, a shunt connector contact 1 is adapted to be mounted within a contact receiving cavity of an insulative housing. Post holding portions 2, 3 are formed adjacent one another along an internal peripheral surface of the contact, and opposing respective pairs of resilient arms 4, 5 are positioned adjacent an insertion opening at both lateral sides of each holding portion. A bridge portion 6 connects front and rear walls of the holding portions at the center thereof. The post holding portions 2, 3, the resilient arms 4, 5 and the bridge portion 6 are integrally formed from a single conductive element so that when the shunt connector engages the post contacts, a reactive force causes some inward deformation of the post holding portions opposite the insertion opening due to an outward force exerted on the resilient arms by the post contacts. As a result, electrical contact is made between the shunt connector assembly and the post contacts due to this deformation.

In the prior art set forth above, the miniaturization of the shunt connector assembly is achieved by the reduction of the actual length or height of the resilient arms of the post holding portions, thereby effecting an overall reduction in the retention forces between the resilient arms of the shunt connector and the post contacts. The retention force that is present between the shunt assembly and the post contacts is due to the integral construction of the contact and, in particular, the closed configuration of the holding portion. However,



5 this construction cannot compensate for the reduction in
resilient deformation due to the shorter effective beam
length of the resilient arms. Furthermore, bridge portion
6 is unitary and therefore is prevented itself from being
resiliently deformed upon insertion of the post contact.
This may cause eventual inelastic deformation of the
resilient arms together with a consequent reduction of the
spring characteristics of the contact and loss of retention
between the shunt assembly and the post contacts
altogether.

Summary of the Invention

Therefore, it is an object of the present
invention to provide a low profile shunt connector which
has contact arms with sufficient effective beam length to
maintain a adequate retention force between the shunt
connector terminals and the mating post contacts.

In order to accomplish the above-mentioned and
other objects, a shunt connector assembly, according to the
present invention, includes an insulative housing defining
a contact-receiving cavity and a contact of a resilient
conductive metal mounted within the contact-receiving
cavity. The contact comprises:

a pair of generally opposing support pieces
extending in a longitudinal direction;

generally parallel resilient arm supporting
portions on each opposite end of each of the pair of
opposing support pieces, and spaced a given dimension
apart;

resilient arms inwardly and downwardly formed
from an upper edge of each arm supporting portion and
extending a given distance beyond the lower edge thereof;
and

an anchor portion extending from a portion of
each support piece and integrally connected to an adjacent
portion of the other of the pair of opposed support pieces;

wherein the resilient arms from one of the arm supporting portions are generally opposite the resilient arms of the other of the arm supporting portions and extend inside the arm supporting portions such that the opposing resilient arms maintain a dimension smaller than the dimension of the corresponding parallel arm supporting portions.

The support pieces include a bridge portion at a central portion thereof from which the anchor portion extends. The housing includes projections extending in a width direction toward the outside surface of the bridge portions to prevent outward deformation thereof. The bridge portion includes an engaging portion for engaging corresponding shoulders in the housing to ensure the retention of the contact within the contact-receiving cavity.

Brief Description of the Drawings

The present invention will be understood more fully from the detailed description given hereinafter and from the accompanying drawings of the present invention, which should not be taken to limit the present invention, but are for explanation and understanding only.

In the drawings:

FIGURE 1 is a perspective view of a contact to be employed in a shunt connector assembly according to the present invention;

FIGURE 2 is a perspective view of the shunt connector assembly which is assembled by mounting the contact of Fig. 1 within an insulative housing;

FIGURE 3 is a plan view of the shunt connector assembly of Fig. 2;

FIGURE 4 is a section of the shunt connector assembly taken generally along line 4 - 4 of Fig 3;

FIGURE 5 is a bottom view of the shunt connector assembly of Fig. 2;



FIGURES 6A and 6B are sections of two embodiments of the shunt connector assembly taken generally along line 6 - 6 of Fig. 4;

5 FIGURE 7 is a section of the shunt connector assembly taken generally along line 7 - 7 of Fig. 4;

FIGURE 8 is a perspective view of the shunt connector assembly shown in mating engagement with post contacts on a printed circuit board;

10 FIGURES 9(A) through 9(C) are explanatory illustrations showing the process of forming the contact of Fig. 1;

FIGURE 10 is a side elevation view showing the contact with a connecting piece in the state of Fig. 9(C); and

15 FIGURE 11 is a perspective view of a prior art shunt connector assembly.

Detailed Description of the Preferred Embodiment

Fig. 1 shows a contact 12 employed in a shunt connector assembly 10 according to the present invention, and Fig. 2 shows the contact of Fig. 1 mounted within an insulative housing 13. As shown in Fig. 1, the contact 12 includes a pair of generally parallel longitudinally extending support pieces 8 and 9 which have contact engaging portions 18 and 20 at both longitudinal ends for engaging two adjacent post contacts 16 mounted on a printed circuit board 14 (see Fig. 8). The contact engaging portions 18 and 20 are connected to each other by a bridge portion 22. Contact engaging portion 18 has opposed resilient arms 18a and 18b extending from arm supporting portions 18c and 18d, respectively, which extend from bridge portion 22 in cantilever fashion and which are spaced for receiving chamfered head portion 16a of contact post 16 (Fig. 8). Similarly, contact engaging portion 20 has opposed resilient arms 20a and 20b supported by arm supporting portions 20c and 20d, respectively, which extend in cantilever fashion from bridge portion 22 and which are



spaced for receiving chamfered head portion 16a of contact post 16. On bridge portion 22, a locking lance 24 extends outwardly along the lower edge of a rectangular hole for locking the contact within insulative housing 13.

5 As can be seen in Fig. 1, resilient contact arms 18a, 18b, 20a and 20b are constructed with curved or radiused portions 18g, 18h and 20g, 20h, connected to arm supporting portions 18c, 18d and 20c, 20d and downwardly extending arm portions 18i, 18j and 20i, 20j connected to
10 the radiused portions.

 Bridge portion 22 has opposing upper portions 22a continuous with arm supporting portions 18c, 18d and 20c, 20d, and an anchor portion 22b connecting the upper portions 22a and bent into a generally U-shaped
15 configuration. Along a portion of the U-shaped anchor portion 22b, cut-outs 22c and shoulders 22d, extending from the lower edge of the cut-outs, are formed.

 Looking now to Fig. 2, contact 12 is mounted within insulative housing 13 which has a substantially
20 rectangular configuration with an outer peripheral wall 26 and a bottom wall 28. Contact-receiving space 30 is surrounded by the outer peripheral wall 26 and the bottom wall 28. The contact-receiving space 30 includes two arm-receiving cavities 32 and a channel 34 for receiving bridge
25 portion 22. The bottom wall 28 is formed with a through hole 36 (Figs. 5-6), through which the mating post contact enters, and projecting portions 28a as described below.

 At a generally central location between the arm-receiving cavities, housing projections 38 extend inwardly
30 toward one another. The inner surfaces of the projections 38 are generally parallel and maintain a given dimension therebetween corresponding to the material thickness of the two opposing upper portions 22a of bridge portion 22.

 Looking now to Fig. 4, projecting portions 28a and downward shoulders 28b of floor 28 engage shoulders 22d
35 of bridge portion 22 to restrict upward movement of contact 12. Furthermore, the vertical edge 28c of projecting



portions 28a engage the side surfaces of anchor portion 22b to restrict movement of the contact 12 in a lateral direction. Also, upper edge 24a of lance 24 engages projecting shoulders 38a on the lower surface of each projection 38, as shown in Fig. 7, to restrict movement of the contact 12 in the upward direction. Finally, vertical surfaces of projections 38 contact opposing vertical surfaces of upper portions 22a of bridge portion 22 to restrict movement of contact 12 in the lateral direction and to restrict the outward resilient deformation of bridge portion 22.

Looking again to housing 13 in Figure 2, longitudinally projecting portions 37 extend inwardly along a longitudinal axis from both ends thereof. The width or lateral of projecting portion 37 is selected to correspond to the distance between the inner surfaces of opposing arm supporting portions 18c and 18d, and 20c and 20d. At both sides of the projecting portions 37, grooves 37a are formed for receiving respective ends 18k, 18l and 20k, 20l of arm supporting portions 18c, 18d and 20c, 20d, respectively.

With the construction described above, contact 12 is mounted securely within housing 13 such that movement of the contact in any direction is minimized.

Next, and with reference to Figs. 9 and 10, the method of forming the contact 12 of the shunt connector assembly will be described. It should be noted that while the contact in different states A, B and C are shown connected to a single common carrier 40, in practice, a strip of contacts for each state or condition is produced in a sequential operation in a series of steps in the order of A - B - C, as described below.

Condition A of Fig. 9 shows the terminal blank punched into a generally H-shaped configuration. The punched piece 100 is connected to common carrier 40 via a connecting leg 42. The punched piece 100 has a symmetrical configuration relative to a central connecting portion 102 which forms anchor portion 22b of bridge portion 22. At



5 both longitudinal ends of central connecting portion 102 are arc-shaped pieces 104 of parallel support pieces 8 and 9 which form upper portions 22a of bridge portion 22 and arm supporting portions 18c, 18d, 20c and 20d. Projecting pieces 106 extend from arc-shaped pieces 104 in a direction substantially parallel to central connecting portion 102. These projecting pieces 106 form resilient arms 18a, 18b, 20a and 20b.

10 The punched terminal piece 100 in condition A is then processed by inwardly forming projecting pieces 106 at a location 108, and extending past the opposite edge of the respective arc-shaped piece 104, into the configuration illustrated as condition B. Then, by forming terminal piece 100 along a centerline 110 of central connecting portion 102, condition is achieved. Connecting portion 102 is formed such that the inner side surfaces of the connecting portion contact each other. Subsequently, by cutting off the completely formed terminal piece 100 at a cutting line 112, contact 12 is separated from common carrier 40 and appears as shown in Fig. 1.

20 It should be noted that rectangular hole and locking lance 24 are stamped from the inside to the outside of contact 12 to ensure that burrs caused by the punching process are not present on the inside of the contact where they could interfere with the mating contact posts 16.

25 After forming, the contact is inserted into housing 13 as shown in Fig. 2. At this time, anchor portion 22 of the contact engages projecting portions 28a (Fig. 4) of the housing at a tapered portion 22e and enters into the space between the two projecting portions 28a resulting in a slight outward deformation of respective projecting portions 28a. Then, by a resilient restoration force of projecting portion 28a, anchor portion shoulder 22d engages housing shoulder 28b in snap engagement. In conjunction therewith, lance 24 contacts the inner surface of projecting portion 38 at both sides and deforms slightly to enter into the space between projecting portions 38.



Thereafter, by the resilient restoration force, the lance engages projecting portion shoulders 38a formed on the lower surface of the projecting portion 38 (Fig. 7). At this time, anchor portion 22b of the contact 12 is firmly fixed within the housing.

The final shunt connector assembly 10 produced by the above-described process is assembled such that respective pairs of resilient arms 18a, 18b and 20a, 20b are aligned with through holes 36 formed through the bottom wall 28 of the housing. The shunt connector assembly 10 is then adapted to engage post contacts 16 in the manner illustrated in Fig. 8 to electrically common, or shunt, a pair of post contacts.

As set forth above, each resilient arm 18a, 18b, 20a and 20b of the contact is formed once toward an opposing arm, and formed again at a position slightly spaced from the arm supporting portions. Therefore, sufficient beam length is maintained to prevent plastic deformation of the resilient arms. To assure engagement with the post contacts, a rounded contact portion 44 is formed on each resilient arm, the position of which contact portion provides a force adequate for retaining the contact on the post contact, but does not cause plastic deformation or take a set. Also, with the resilient arm constructed as set forth above, the total force of the contact includes both the spring force of the material and the resilient force created by forming the arm and therefore assures sufficient retention force between the shunt connector assembly and the post contact. Figure 6A shows a first embodiment of the shunt connector assembly showing the location of rounded contact portions 44 along resilient arms 20a and 20b and near a distal end thereof. Figure 6B shows a second embodiment of the shunt connector assembly showing the location of rounded contact portions 44 along resilient arms 20a and 20b approximately midway along the resilient arm and therefore the same distance from the top and the bottom surfaces of the housing. This



second embodiment allows placement of the shunt assembly on the contact posts without first orienting the housing, i.e. making the connector assembly more "user friendly".

5 Furthermore, according to the present invention, since the upper portions of the bridge are in contact, and since the contact is manufactured from a single integrally formed piece of metal, an additional opposing force in the resilient arms is generated and transferred back to the contact posts due to the force applied at the bridge
10 portion during the initial deformation during insertion of the post contacts into the shunt assembly. This reactive or opposing force is propagated to the resilient arm and as a result, the frictional forces between the shunt assembly contact arms and the post contact are increased to
15 correspondingly increase the retention forces of the connector assembly on the post contacts.

Although the invention has been illustrated and described with respect to exemplary embodiment thereof, it should be understood by those skilled in the art that the
20 foregoing and various other changes, omissions and additions may be made therein and thereto, without departing from the spirit and scope of the present invention. Therefore, the present invention should not be understood as limited to the specific embodiment set out
25 above but to include all possible embodiments which can be embodied within a scope encompassed and equivalents thereof with respect to the feature set out in the appended claims.

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CLAIMS

1. A shunt connector assembly (10) including an insulative housing (13) defining a contact-receiving cavity (30) and a contact of a resilient metal received and fixed within the contact-receiving cavity, said contact comprising:

a pair of generally opposing support pieces (8,9) extending in a longitudinal direction;

resilient arm supporting portions (18c,18d,20c,20d) on each opposite end of each of the pair of opposing support pieces, and spaced a given dimension apart,

a pair of resilient arms (18a,18b,20a,20b) extending inwardly from an upper edge of each arm supporting portion and projecting downwardly beyond the lower edge of each arm supporting portion; and

an anchor portion (22b) extending from a portion each support piece and integral with an adjacent portion of the other of the pair of support pieces;

wherein each resilient arm is opposite a resilient arm from the opposing arm supporting portion and is spaced apart a dimension less than the dimension of the parallel arm supporting portions.

2. A shunt connector assembly as set forth in claim 1, further comprising a bridge portion (22) connecting the resilient arm supporting portions (18c,18d,20c,20d), wherein said bridge portion includes upper portions (22a) in contact with one another.

3. A shunt connector assembly as set forth in claim 2, wherein said housing has lateral projections which extend toward the upper portions (22a) of the bridge portion for preventing outward deformation of said bridge portion.





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4. A shunt connector assembly as set forth in
claim 3, wherein said upper portions of said bridge portion
is continuous with said anchor portion, and wherein the
anchor portion includes a lance (24) for securing the
5 contact within the housing.

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