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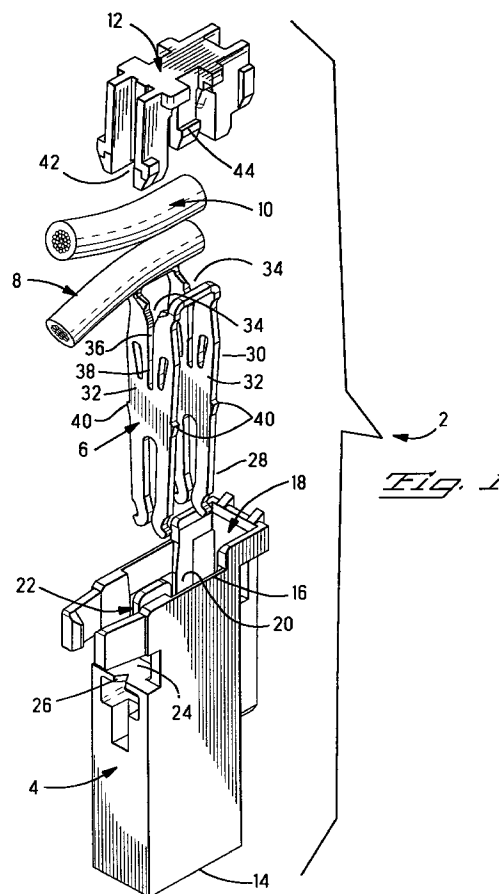
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(54) **Insulation displacement electrical connector for multiple inline conductors**

(57) An electrical connector (2) comprising: a contact (6) having a mating portion (28) and a conductor engaging portion (30) that includes a plate (32) having an insulation displacement contact (IDC) slot (34) therein for engaging a transversely oriented conductor (8,10) when forced therein; a connector body (4) having a mating end (14) and a conductor engaging end (16) with a contact receiving passageway (18) extending therebetween that includes a cover receiving pocket (20) towards the conductor engaging end (16), and an access slot (22) extends into the body (4) from the conductor engaging end (16) thereby providing transverse access to the passageway (18), where the contact (6) is located in the passageway (18) with the IDC slot (34) corresponding to the access slot (22) such that the conductor (8,10) is insertable into the IDC slot (34) from the conductor engaging end (16); and, a cover (12) is receivable in the cover receiving pocket (20) upon insertion of the conductor (8,10); the connector (2) being characterized in that : the IDC slot (34) is adapted to have two in-line first and second contact sections (36,38) therealong and the connector body (4) includes a frangible beam (24) extending across the access slot (22) at a location corresponding to a position between the first and second contact sections (36,38) where said beam (24) is breakable to provide access to the second contact section (38).



*Fig. 1*

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## Description

The present invention relates to electrical connectors having contacts therein with an insulation displacement contact (IDC) slot for engaging a conductor oriented transversely thereto.

Connectors of this type have become increasingly popular in automotive and appliance industries as they are well adapted for production assembly and ensure a reliable electrical connection for use in environment subject to vibration. Known connectors incorporate a contact mounted in the cavity of an insulating body where a cover member is used to hold the transverse conductor in position. This known connector and improvements thereto is more fully described in US-A-4,830,625 and EP-A-0 317 099.

In some instances, it would be desirable to have the flexibility to terminate multiple conductors in a single IDC slot or to be able to selectively terminate conductors of different sizes. With respect to the latter, a contact incorporating multiple IDC contacting sections can be provided in a single slot adapted to engage multiple conductors, even those having different size wires. Examples of contacts capable of solving this problem have been set out in FR-A-2 419 594; US-A-4,060,302; GB-A-2 130 815; and WO 95/31014.

A problem inherent in contacts of this type is that it is difficult to ensure the stability of the electrical engagement, especially where only a single conductor is inserted into one of the contact sections that is not the one at the bottom of the slot. It would be highly desirable to be able to provide a connector similar to that of the prior art that would be useable in high vibration environments and incorporate the advantages of having contacts adapted to receive multiple inline conductors in an IDC manner.

These and other objects are accomplished by providing an electrical connector 2 comprising: a contact 6 having a mating portion 28 and a conductor engaging portion 30 that includes an insulation displacement contact (IDC) slot 34 therein for engaging a transversely oriented conductor 8,10 when forced therein; a connector body 4 having a mating end 14 and a conductor engaging end 16 with a contact receiving passageway 18 extending therebetween, and an access slot 22 extends into the body 4 from the conductor engaging end 16 thereby providing transverse access to the passageway 18, where the contact 6 is located in the passageway 18 with the IDC slot 34 corresponding to the access slot 22 such that the conductor 8,10 is insertable into the IDC slot 34 from the conductor engaging end 16; the connector 2 being characterized in that: the IDC slot 34 is adapted to have two in-line first and second contact sections 36,38 therealong and the connector body 4 includes a frangible beam 24 extending across the access slot 22 at a location corresponding to a position between the first and second contact sections 36,38 where said beam 24 is deformable to provide access to

the second contact section 38.

Advantageously, the present invention provides stabilization of a single conductor inserted partially along the slot such that a reliable connection is established even in high vibration environments while still enabling multiple conductors or a single conductor to be inserted into a lower engaging section by deforming the beam.

The present invention will now be described by way of example with reference to the drawings wherein;

Figure 1 is an exploded perspective view of a connector according to the present invention;

Figure 2 is an upper perspective view of an electrical connector body and cover incorporating multiple contact passageways;

Figure 3 is a lower perspective view of the connector body in cover of Figure 2;

Figure 4 is a side perspective view of the contact illustrated in Figure 1;

Figure 5 is a side perspective view of the contact of Figure 4 showing multiple conductors terminated therein;

Figure 6 is a front view of the assembled connector of Figure 1 showing a single conductor supported by a deformable beam; and

Figure 7 is a front view of the connector of Figure 1 showing multiple conductors inserted therein with the deformable beam being displaced.

With reference now to Figure 1, a single cell of an electrical connector according to the present invention is shown generally at 2. The electrical connector includes a connector body 4 into which a contact 6 is inserted for engaging at least one conductive lead 8,10 where a cover 12 is inserted thereover.

The connector body 4 includes a mating end 14 and a conductor engaging end 16 with a contact receiving passageway 18 extending therebetween. At the conductor engaging end 16 of the connector body 4 the contact receiving passageway 18 includes a cover receiving pocket 20. An access slot 22 extends into the body 4 from the conductor engaging end 16 thereby providing transverse access through at least one side of the connector body 4 and into the contact receiving passageway 18. A deformable beam 24, which in this embodiment is frangible, extends across the access slot 22 at some distance above the bottom of the slot. Note, with reference to Figure 7 the deformable beam 24 can be broken in two however, the beam 24 may also be deformed without breaking if desired. The transverse and frangible beam 24 includes a feature 26 such as a notch that will localize the fracture of the beam 24 as described below.

The contact 6 includes a mating end 28 and a conductor engaging end 30. The conductor engaging end 30 is formed with opposing plates 32 having aligned IDC slots 34 for engaging a transversely oriented conductor 8,10. The IDC slots 34 each include a first con-

tacting section 36 and a second contacting section 38 disposed sequentially in line with one another along the direction of insertion of the transverse conductors 8,10. The contact 6 is located within the terminal receiving passageway 18 of the connector body 4 by way of positioning features 4.

The cover member 12 is provided with a pressing surface 42 for use either to stuff the conductive leads 8,10 into the IDC slots 34 of the contact 6 or to stabilize one of the leads 8,10 therein. In order to assure that the cover member 12 remains positioned within the pocket 20 of the connector body 4, latch members 44 are provided, thereby preventing the cover from being expelled and possible disengagement of the lead and contact interface.

With reference now to Figures 2 and 3, a connector housing 104 is shown incorporating multiple integrally moulded connector bodies 4. Further shown is a strip 112 of multiple covers 12. The contacts 6, described below with reference to figures 4 and 5, are received in the passageways 18 of each connector body 4 that makes up the connector housing 104. While it is envisioned that contacts having multiple inline engaging sections will be used in all of the cavities 18 other the contacts may be advantageously used including those with only a single engaging section as is known from the prior art. The connector housing 104 and the associated cover strip 112 are described in greater detail in the aforementioned patent publications incorporated by reference.

With reference now to Figures 4 and 5, the contact 6 is shown. The contact 6 includes the mating end 28 having opposing legs 46 extending from each of the plates 32. The legs 46 extend to outwardly turned ends 48 enabling insertion of printed circuit board pads for a mating tab therebetween. Opposite to the mating end 28 the plates 32 include IDC slots 34 oriented in line with one another. Each IDC slot includes a first contact section 36 and a second contact section 38 oriented therebelow when viewed from the direction of insertion of a conductive lead. Below the second contacting section 38, the IDC slot 34 has a bottom 50. On opposite sides of the slot 34 at the second contact section 38 a pair of perimeter cutouts 52 are formed together that define resilient beam sections 54. As some resilience is necessary at each of the first and second contact sections 36,38, these beam sections 54 enhance the ability to isolate the engagement forces necessary for each of the conductive leads when they are respectively inserted into the contact sections 36,38. Opposite the bottom of the slot 50 are a pair of cutting edges 56 that define a mouth therebetween for receiving the conductors therein. A pair of straps 58 hold the opposing plates 32 together. By inserting multiple leads 8,10 into the IDC slot 34 multiple leads 8,10 may be engaged in a stacked and in lined fashion. Advantageously, where different sized leads are to be used the lower or second contact section 38 would be used for the smaller lead 8

while the first or upper contact section 36 would be used for the larger lead 10. In the alternative, the contacting sections 36,38 could be sized to receive the same size conductive leads 8,10. As stated above, there are many configurations of IDC slots that may be advantageously used in a connector of this type.

With reference now to Figure 6, the connector 2 of Figure 1 is shown having a single conductive lead inserted into the first conductor engaging section 36 of the IDC slot 34. In this position, the cover 12 is in supporting engagement with the conductive lead 8 along pressing surface 42. The conductive lead 8 is also supported by the frangible beam 24 extending across the slot 22. The support above and below the conductive lead 8 assures that the conductive lead is held stable within the IDC slot 34 even in the first conductor engaging section 36 which is only partially along the IDC slot 34.

With respect now to Figure 7, where a conductor 8 is to be inserted into the second engaging section of slot 34, the support beam 24 is broken at the notch 26 and pushed out of the way as segments 24a,b. In the case shown, a second conductor 10 is inserted thereover and as a result of using the same cover 12 as shown in Figure 6, the biasing surface 42 is at the same location and sits above the second conductor 10 maintaining both in their respective region. This conductor 8 is now supported at the bottom of the slot 34 where it is stably located. It may also be possible to provide two latched positions in the cover receiving pocket for the cover 12 such that the cover would be further inserted so that surface 42 would sit upon a single conductor 8 in the second region 38 without requiring a different cover 12.

Advantageously then, the present invention provides an electrical connector suitable for IDC termination of one or more conductors in one or more positions along an IDC slot of a contact therein in a manner that is stable and reliable. Furthermore, where multiple conductors are to be used the same cover unit may be employed to see both conductors in their respective positions or with the case of a single conductor to see the conductor in the first contact section. Finally, the cover unit 12 may be used to effect the stuffing of the transverse conductors 8,10 or simply maintain them in their location after being stuffed into the IDC slot by a termination machine.

## Claims

1. An electrical connector (2) comprising: a contact (6) having a mating portion (28) and a conductor engaging portion (30) that includes an insulation displacement contact (IDC) slot (34) therein for engaging a transversely oriented conductor (8,10) when forced therein; a connector body 4 having a mating end (14) and a conductor engaging end (16) with a contact receiving passageway (18) extending therebetween, and an access slot (22) extends into

the body (4) from the conductor engaging end (16) thereby providing transverse access to the passageway (18), where the contact (6) is located in the passageway (18) with the IDC slot (34) corresponding to the access slot (22) such that the conductor (8,10) is insertable into the IDC slot (34) from the conductor engaging end (16); the connector (2) being characterized in that : the IDC slot (34) is adapted to have two in-line first and second contact sections (36,38) therealong and the connector body (4) includes a deformable beam (24) extending across the access slot (22) at a location corresponding to a position between the first and second contact sections (36,38) where said beam (24) is breakable to provide access to the second contact section (38).

2. The electrical connector (2) of claim 1 wherein the deformable beam is relieved to localize the deformation location.
3. The electrical connector (2) of claim 1 or 2 wherein the contact includes two plates spaced from each other having insulation displacement contact slot therein where the two plates are joined together by straps, thereby forming a U-shaped contact member.
4. The electrical connector of any one of the preceding claims are now including a cover that has latches for engaging the connector body to retain the cover therewith, the cover being receivable in a cover receiving pocket (20) of the connector body (4) located towards the conductor engaging end (16).
5. The electrical connector of any one of the preceding claims further characterized in that the cover includes a pressing surface (42) that cooperates with one of the leads (8,10)
6. The electrical connector of any one of the preceding claims further characterized in that the deformable beam is frangible.
7. The electrical connector of any one of the preceding claims further characterized in that the deformable beam includes a feature (26) to localize the deformation.

