Slotted plate electrical connector

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This invention relates in general to the art of making electrical line connections and relates in particular to an electrical connector of the slotted plate type.

There is known for example from our United States Patent Specification No. 3,760,335 an electrical connector comprising an insulating housing having a cavity receiving an electrical terminal provided with a wire receiving slot therein into which an electrical wire is insertable in a direction transversely of the longitudinal axis of the wire to make electrical connection between the wire and the terminal.

In such known connectors, the wire is inserted into the slot of the terminal by moving the wire laterally of its axis and into the slot. The housing must therefore be provided with an opening through which the wire can be moved laterally into the slot of the terminal, and through which it projects when the connection has been made. This requirement necessarily limits the manufacturer's freedom of design of the housing, as well as limiting the number and arrangement of the cavities where the connector is of the multiterminal kind, since lateral access for a wire to be connected to each terminal must always be provided.

There is described, however, in French Patent Specification No. 2,160,036 an electrical connector comprising an insulating housing having a wire receiving face, a contact receiving cavity extending into the wire receiving face, and an electrical contact terminal in the cavity, the terminal having a wire connecting portion which is proximate to the wire receiving face, the wire connecting portion which has been bent back upon itself having a wire receiving slot for establishing electrical contact with a wire, a wire receiving opening which is adjacent to the wire receiving face, and a free end which is generally opposite to the wire receiving opening and is located inwardly of the cavity from the opening, the wire receiving slot extending inwardly from the free end, the wire connecting portion being deformable to move the free end towards a wire which has been inserted through the opening so as to extend beyond the free end; whereby the wire is received in the wire receiving slot.

Although in the case of the connector described in the French patent specification mentioned above, the wire is inserted axially into the cavity in the housing and thence into the terminal, it is then necessary to retract the terminal into the cavity, in order to cause a wall portion of the cavity to act upon the wire connecting portion of the terminal to move the free end of such portion against the wire. The retractile movement of the terminal also causes it to lock in the cavity.

Since in its unretracted position, the terminal is not locked in the cavity so that it would be impracticable for the manufacturer to supply the user with a housing with the terminal ready assembled therein, the user must first place the terminal in the housing cavity before inserting the wire and retracting the terminal.

According to the present invention a connector as defined in the fourth paragraph of this specification is characterised in that the wire connecting portion has an arcuate part comprising the free end, such free end being guidable towards and past the wire by an arcuate wall surface of the cavity which wall surface has a radius of curvature which is substantially equal to that of the arcuate part of the wire connecting portion.

Since the terminal does not need to be moved in the cavity in order to connect the wire thereto, the housing can be supplied to the user with the terminal already in its final position in the cavity. Thus, all the user need do to connect the terminal to the wire is to insert the wire into the cavity and thence into the terminal and then to deform the wire connecting portion of the terminal by means of a tool inserted axially into the cavity so that the end of the tool engages the wire connecting portion. The tool can be in the form of a simple tongue which need in no way be especially shaped for its purpose.

There is disclosed in German Patent Specification No. 2,023,170, an electrical connector comprising an insulating housing having a cavity containing an electrical terminal provided with a wire connecting portion which has been bent back upon itself and which has a free end having a slot into which a wire, inserted axially into the cavity and across the mouth of the slot can be forced, by deforming the wire connecting portion by means of a tool also inserted axially into the cavity. However, the wire connecting portion does not have a wire receiving opening and in order correctly to deform the terminal, the tool must be inserted between the wire connecting portion and the adjacent wall of the cavity. Not only must the tool be especially contoured so as to deform the wire connecting portion, but a space for receiving the tool must be provided between the wire connecting portion and the housing so that the housing must be of greater dimensions laterally of the insertion direction of the tool than if no such tool receiving space were required.

Since, according to the present invention, the deformation of the wire connecting portion is controlled by virtue of the arcuate wall surface of the cavity, the tool end need only be applied in abutment against the wire connecting portion and may be of simple rectangular shape.

For a better understanding of the invention reference will now be made by way of example to the accompanying drawings, in which:—

Figure 1 is a perspective, partially exploded,
view of an electrical connector comprising an insulating housing containing electrical terminals;

Figure 2 is a sectional view of the housing taken on the lines II—II of Figure 3;

Figure 3 is a view taken on the lines III—III of Figure 2:

Figure 4 is an enlarged fragmentary sectional view of the connector, illustrating the use of a tool for connecting wires to the terminals;

Figure 5 is a plan view of the leading end portion of a progression strip illustrating a partially formed, and a fully formed, terminal for the connector;

Figures 6 and 7 are small scale perspective views illustrating respective modifications of the housing.

As shown in Figures 1 to 3, an electrical connector comprises a rectangular insulating housing 4 having a wire receiving end face 6, a mating end face 8, and lateral faces 10 and 12. A pair of superposed cavities 14 for receiving electrical terminals 16 extend through the housing 4 from the face 6 to the face 8.

The terminals 16 are manufactured by stamping and forming, as a continuous metal progression strip 18 (Figure 5) with adjacent terminals of the strip connected by slugs 50 of the strip material. Figure 5 shows the fully formed end terminal of the strip and the next adjacent terminal which has only partially been produced and is in the form of a flat stamped out blank 16'. Each terminal 16 has a contact spring portion 20 at its forward or mating end, an intermediate portion 22, and a wire receiving portion 24 at its rearward end. The intermediate portion 22 comprises a rectangular plate 26 from which extends a locking tongue 28 for retaining the terminal 16 in the housing 4. The contact portion 20 is in the form of a contact spring extending obliquely from the plate 26 and having bent at 32 to provide a downwardly (as seen in Figures 1 and 4) bent top portion 34. The portion 20 is slightly narrower than the plate 26 to provide leftwardly (as seen in Figures 1, 4 and 5) directed shoulders 31. The contact spring portion 20 is intended to establish contact, for example, with an electrical post (not shown) or a similar contact member.

The wire receiving portion 24 comprises a short flat base 38 which is connected to the plate 26 by an offset 36 from which a stop 37 has been struck. From the side of the base 38 remote from the offset 36, an arcuate part 40 of the wire receiving portion 24 extends over the base 38 with its concave surface facing the base 38. It will be apparent from Figure 6 that the part 40 has been produced by curling the flat stamped out blank 16' through an angle of substantially 260°, the radius of curvature of the part 40 being such that its free end portion 42 is disposed above, and in alignment with, the offset 36. By virtue of an opening 46' stamped in the blank 16', the length of the part 40 which is to overlie the offset 36 and base 38 is connected to the offset 36 only by a pair of straps 48' of the blank spanned by a rectilinear edge 73 at the rightward (as seen in Figure 5) of the opening 46'. When the part 40 has been curled over, a wire receiving opening 46 bounded laterally by arcuate straps 48 and spanned above the base 38 by the edge 73 is thus provided in the part 40. The free end portion 42 of the part 40 has a wire receiving slot 44 extending inwardly thereof, the width of the slot 44 being such that upon an insulated wire 72 being relatively moved into the slot 44, the insulation of the wire is displaced and the edges of the slot establish secure electrical contact with the electrically conductive core of the wire 72.

Each of the cavities 14 comprises an enlarged pocket portion 52 extending inwardly from the wire receiving face 6 and a smaller, generally rectangular, portion 62 extending inwardly from the mating face 8 and communicating with the portion 52 intermediate the ends of the cavity 14. The portion 52 has (as best seen in Figure 3) parallel sidewalls 54, a top wall 56, and a floor 60. The top wall 56 merges at its inner end with an arcuate wall portion 58 bridging spaced arcuate wall portions 59, at the intersection between the portions 52 and 62 of the cavity 14. The wall portions 56 and 59 have substantially the same radius of curvature as the part 40 as will be apparent from the upper part of Figure 4. A lip 66 provided at the inner end of the floor 60 presents oppositely directed shoulders 67 and 69 which co-operate with the locking tongue 28 and the stop 37 of the terminal to prevent movement of the terminal in either direction after insertion into the cavity 14, as will be apparent from Figure 4. Grooves 88 in the sidewalls of the portion 62 of the cavity 14 receive the lateral edges of the plate 26 of the terminal, the shoulders 31 of the terminal abutting the forward ends 71 of the grooves 88 as shown in Figure 4. The part of the contact spring portion 20 adjoining the plate 26 of each terminal is supported by shoulders 63 in portion 62 of the cavity 14.

It will be apparent that the terminals can be inserted into the cavities 14 by properly orienting the terminals relative thereto and moving the terminals through the cavities from the wire receiving face 6 towards the mating face 8, the terminals being located and retained in the cavity 14 by virtue of the co-operation between the tongue 28 and shoulder 67 and between the stop 37 and the shoulder 69. A groove 64 in the floor 60 of the portion 62 of each cavity 14 permits an extraction tool (not shown) to be used to depress the tongue 28 to release the terminal so that it can be removed from the housing 4.

As shown in Figure 4, the wire receiving portions of the terminals fit snugly in the
portions 52 of the cavities 14 with the free end portions 42 abutting the arcuate wall portions 58 of the cavities 14.

When a wire 72 is to be connected to one of the terminals 16 in the housing 4, an end of the wire 72 is aligned with the receiving opening 46 of the terminal and is then inserted through the opening 46 until the wire end extends beyond the free end portion 42 of the terminal into the cavity portion 62 as shown in the upper part of Figure 4. A tool blade in the form of a simple rectangular cross-section tongue, inserted axially into the cavity portion 52 (see Figure 4), is then forced against the edge 73 of opening 46 of the terminal to deform the part 40 of the terminal as shown in the lower part of Figure 4, so that the free end portion 42, guided by the arcuate surfaces 58 and 59, moves along an arcuate path which intersects the longitudinal axis of the inserted wire 72. During such movement, the portion 42 moves past the electrically conductive core (not shown) of the wire 72 which remains substantially stationary by abutment against the plate 26, the edges of the slot penetrating the insulation of the wire so that the core is received in the slot 44 to establish permanent electrical contact between the core and the walls of the slot 44. Although the wire remains substantially stationary, the relative movement of the free end portion 42 with respect to the wire is substantially the same as if the wire were moved laterally of its axis and into the wire receiving slot 44. The wire is supported by the plate 26 in spaced relation to the base 38, by virtue of the provision of the offset 36 thus allowing full penetration of the insulation of the wire by the free end portion 42.

The electrical connection between the terminal and the wire core is achieved by the progressive curling over of the part 40 of the terminal, by engagement of the parts of the free end portion 42 bounding the slot 44, with the arcuate wall portions 59, accompanied by a partial flattening of the part 40 as shown in the lower part of Figure 4, so that the final shape of the wire receiving portion 24 of the terminal is substantially that of an oval on a flat base (see the lower part of Figure 4). The precise shape of the wire receiving portion of the terminal after it has been deformed in this way will depend upon several factors, including the insulating characteristics and thickness of the metal stock from which the terminal was made and the manner in which the deforming force is applied to the part 40 of the terminal. However, some further curling of the part 40 must take place if the free end portion 42 thereof is to be moved through the insulation of the wire 72. Other flattening or compressing techniques might be used to achieve movement of the free end portion 42 through the insulation of the wire in response to the application to the edge 73 of a force in a direction parallel to the longitudinal axis of the wire.

The metal stock from which the terminal strip is manufactured must be selected with some care if the curling of the wire receiving portion of the terminal as shown in Figure 4 is to be achieved. In general, a spring hard material should be chosen since a spring material will tend to curl upon application of the force against the edge 73, and is also required to ensure the permanence of the electrical connection between the wire core and the walls of the slot 44 in the free end portion 42. A suitable spring hard material, for example, is a spring hard phosphor bronze or a suitable brass composition. The force required to bring about the curling operation can also be controlled to some extent by appropriately choosing the dimensions of the opening 46' in the blank shown in Figure 5. Reducing the width of the straps 48' will result in a reduction in the force required to bring about the curling operation.

Under some circumstances, the part 40 of the terminal may spring back slightly after the tool blade 70 has been removed from the cavity 14. Such spring back will not however disturb the electrical connection between the terminal and the wire since the spring back will occur at locations remote from the free end portion 42, for example at the base 38.

Since the wire is moved axially into the terminal rather than laterally of its axis into the terminal, the force which causes the terminal to be connected to the wire is applied in a direction parallel to the axis of the wire. The cavities containing the terminals need not therefore be accessible from a side surface of the housing. By virtue of this feature, electrical connectors having several rows of terminals and circular cross-section multi-cavity electrical connectors, as shown in Figures 6 and 7 respectively, can be provided with slotted plate terminals, without access to the slots thereof being inhibited.

Claims

1. An electrical connector comprising an insulating housing (4) having a wire receiving face (6) a contact receiving cavity (14) extending into the wire receiving face (6), and an electrical contact terminal (16) in the cavity (14), the terminal (16) having a wire connecting portion (24) which is proximate to the wire receiving face (6), the wire connecting portion (24) which has been bent back upon itself having a wire receiving slot (44) for establishing electrical contact with a wire (72), a wire receiving opening (46) which is adjacent to the wire receiving face (6), and a free end (42) which is generally opposite to the wire receiving opening (46) and is located inwardly of the cavity (14) from the opening (46), the wire receiving slot (44) extending inwardly from the free end (42), the terminal connecting portion (24) being deformable to move the free end (42) towards a wire (72) which has been inserted through the opening (46) so as to extend
7 0 0 0 0 6 2 4

beyond the free end (42); whereby the wire (72) is received in the wire receiving slot (44); characterised in that the wire connecting portion (24) has an arcuate part (40) comprising the free end (42), such free end (42) being guidable towards and past the wire (72) by an arcuate wall surface (58, 59) of the cavity (14), which wall surface (58, 59) has a radius of curvature which is substantially that of the arcuate part (40) of the wire connecting portion (24).

2. A connector according to Claim 1, characterised in that the arcuate wall surface (58, 59) is such that the radius of curvature of the arcuate part (40) is reduced as the free end (42) is moved towards the wire (72).

3. A connector according to Claim 1 or 2, characterised in that the parts of the free end portion of the wire connecting portion (24), bounding the slot (44) are guidable by individual arcuate wall surfaces (59) of the cavity (14).

4. A connector according to Claim 1, 2 or 3, characterised in that the wire receiving opening (46) is so dimensioned and oriented that a tool (70) inserted axially into the cavity (14) is engangeable with an edge of the wire receiving opening (46) when the wire (72) has been passed through such opening (46), to deform the wire connecting portion (24).

5. A connector according to any one of the preceding claims, characterised in that the wire connecting portion (24) comprises a flat base (38) from an edge of which the arcuate part (40) of the wire connecting portion (24) extends so as to overhang the base (38) with the concave inner surface of such arcuate part (40) facing the base (38) and the free end (42) also facing the base (38), the base (38) being connected to a wire end supporting plate (26) of the terminal by an offset (36) so that when the wire (72) has been inserted through the wire receiving opening (46) with its end supported on the wire end supporting plate (26) of the terminal, the wire (72) is spaced from the base (38).

Revidcations

1. Connecteur électrique comprenant un boîtier isolant (4) qui présente une face (6) de réception de fils, une cavité (14) de réception d’un contact pénétrant dans la face (6) de réception de fils et une borne (16) de contact électrique logée dans la cavité (14), la borne (16) comportant une partie (24) de connexion à un fil qui est proche de la face (6) de réception de fils, la partie (24) de connexion, qui a été repliée sur elle-même, présentant une fente (44) de réception d’un fil destinée à établir un contact électrique avec un fil (72), une ouverture (46) de réception d’un fil adjacente à la face (6) de réception de fils, et une extrémité libre (42) qui est sensiblement opposée à l’ouverture (46) de réception d’un fil et qui est située vers l’intérieur de la cavité (14) par rapport à l’ouverture (46), la fente (44) de réception d’un fil partant vers l’intérieur de l’extrémité libre (42), la partie (24) de connexion à un fil étant déformable de manière à déplacer l’extrémité libre (42) vers un fil (72) qui a été inséré dans l’ouverture (46) afin de dépasser l’extrémité libre (42), de façon que le fil (72) soit reçu dans la fente (44) de réception d’un fil, caractérisé en ce que la partie (24) de connexion d’un fil présente un tronçon courbe (40) comprenant l’extrémité libre (42), cette extrémité libre (42) pouvant être guidée vers le fil (72) et au-delà de ce fil par une surface de paroi courbe (58, 59) de la cavité (14), laquelle surface de paroi (58, 59) présente un rayon de courbure qui est à peu près égal à celui du tronçon courbe (40) de la partie (24) de connexion d’un fil.

2. Connecteur selon la revendication 1, caractérisé en ce que la surface de paroi courbe (58, 59) est telle que le rayon de courbure du tronçon courbe (40) est réduit lorsque l’extrémité libre (42) est déplacée vers le fil (72).

3. Connecteur selon la revendication 1 ou 2, caractérisé en ce que les parties du tronçon extrême libre de la partie (24) de connexion d’un fil, délimitant la fente (44), peuvent être guidées par des surfaces de parois courbes séparées (59) présentées par la cavité (14).

4. Connecteur selon la revendication 1, 2 ou 3, caractérisé en ce que l’ouverture (46) de réception d’un fil est dimensionnée et orientée de manière qu’un outil (70), inséré axialement dans la cavité (14), puisse être engagé contre un bord de l’ouverture (46) de réception d’un fil lorsque le fil (72) a été introduit dans cette ouverture (46), afin de déformer la partie (24) de connexion d’un fil.

5. Connecteur selon l’une quelconque des revendications précédentes, caractérisé en ce que la partie (24) de connexion d’un fil comprend une base plate (38) d’un bord de laquelle le tronçon courbe (40) de la partie (24) de connexion d’un fil fait saillie afin de se trouver au-dessus de la base (38) de telle manière que la surface intérieure concave de ce tronçon courbe (40) soit tournée vers la base (38) et que l’extrémité libre (42) soit également tournée vers la base (38), la base (38) étant reliée par un coude (38) à une plaque (26) de support de l’extrémité d’un fil faisant partie de la borne de manière que, lorsque le fil (72) a été inséré dans l’ouverture (46) de réception d’un fil et que son extrémité est supportée par la plaque (26) de la borne, le fil (72) soit espacé de la base (38).

Patentansprüche

1. Elektrischer Verbinde mit einem Isoliergehäuse (4), das eine Drahtaufnahmeseite (6), einen sich in die Drahtaufnahmeseite (6) hinein erstreckenden Kontaktlaufnahmehohlraum (14), sowie einen elektrischen Kontaktanschluß (16) in dem Hohlraum (14) aufweist, wobei der An-
schluß (18) einen in der Nähe der Drahtaufnahmesite (6) befindlichen Drahtverbindungsabschnitt (24) aufweist, der zu sich selbst zurückgebogen ist und zur Erstellung eines elektrischen Kontakts mit einem Dreh (72) einen Drahtaufnahmeschlit (44) aufweist, mit einer der Drahtaufnahmesite (6) benachbarten Drahtaufnahmeöffnung (48), und mit einem freien Ende (42), das sich im großen und ganzen gegenüber der Drahtaufnahmeöffnung (48) befindet und von der Öffnung (46) aus in das Innere des Hohlrums (14) gehend angeordnet ist, wobei sich der Drahtaufnahmeschlit (44) von dem freien Ende (42) aus nach innen erstreckt und der Drahtverbindungsabschnitt (24) zur Bewegung des freien Endes (42) in Richtung auf einen Dreh (72) verformbar ist, der durch die Öffnung (48) derart eingeführt worden ist, daß er sich über das freie Ende (42) hinaus erstreckt, wodurch der Dreh (72) in den Drahtaufnahmeschlit (44) aufgenommen wird, dadurch gekennzeichnet, daß der Drahtverbindungsabschnitt (24) einen bogenförmigen Teil (40) aufweist, der das freie Ende (42) umfaßt, wobei dieses freie Ende (42) mittels einer bogenförmigen Wandfläche (58, 59) des Hohlrums (14) in Richtung auf den Dreh (72) und an diesem vorbei führbar ist, wobei die Wandfläche (58, 59) einen Krümmungsradius aufweist, der dem des bogenförmigen Teils (40) des Drahtverbindungsabschnitts (24) im wesentlichen gleich ist.

2. Verbinder nach Anspruch 1, dadurch gekennzeichnet, daß die bogenförmige Wandfläche (58, 59) so ausgebildet ist, daß der Krümmungsradius des bogenförmigen Teils (40) reduziert wird, wenn das freie Ende (42) in Richtung auf den Dreh (72) bewegt wird.

3. Verbinder nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Teile des freien Endeschnitts des Drahtverbindungsabschnitts (24), die den Schlit (44) begrenzen, mittels einzelner bogenförmiger Wandflächen (59) des Hohlrums (14) führbar sind.

4. Verbinder nach Anspruch 1, 2 oder 3, dadurch gekennzeichnet, daß die Drahtaufnahmeöffnung (46) derart dimensioniert und ausgeführt ist, daß ein axial in den Hohlrum (14) eingeführtes Werkzeug (70) zum Zweck der Verformung des Drahtverbindungsabschnitts (24) an einem Rand der Drahtaufnahmeöffnung (46) angreifen kann, wenn der Dreh (72) durch diese Öffnung (46) geführt worden ist.

5. Verbinder nach einem der vorausgehenden Ansprüche, dadurch gekennzeichnet, daß der Drahtverbindungsabschnitt (24) eine flache Basis (38) aufweist, wobei sich von einem Rand derselben der bogenförmige Teil (40) des Drahtverbindungsabschnitts (24) derart erstreckt, daß er einen Überhang zur Basis (38) bildet, wobei die konvexe Innere Fläche des bogenförmigen Teils (40) der Basis (38) zugewendet ist und das freie Ende (42) ebenfalls der Basis (38) zugewendet ist, und daß die Basis (38) mit einer Drahtende- Trageplatte (26) des Anschlusses über einen Versatz (36) derart verbunden ist, daß sich der Dreh, nachdem er durch die Drahtaufnahmeöffnung (46) eingeführt worden ist und sein Ende sich auf der Drahtende-Trageplatte (26) des Anschlusses abstützt, in einem Abstand von der Basis (38) befindet.