July 20, 1965 M. SAMS ETAL 3,196,379

ELECTRICAL CONNECTOR

Filed July 11, 1962 2 Sheets-Sheet 1

FIG. 1

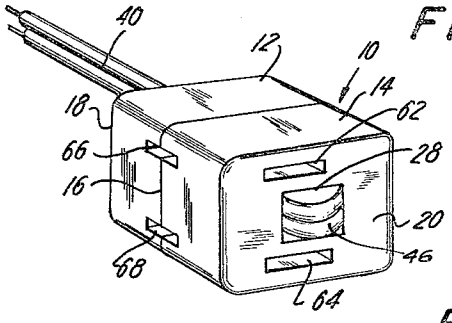


FIG. 2

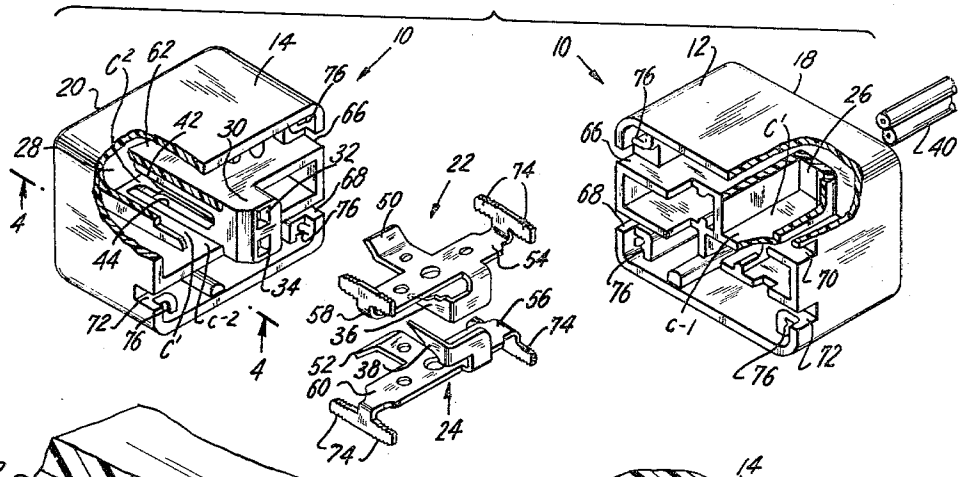
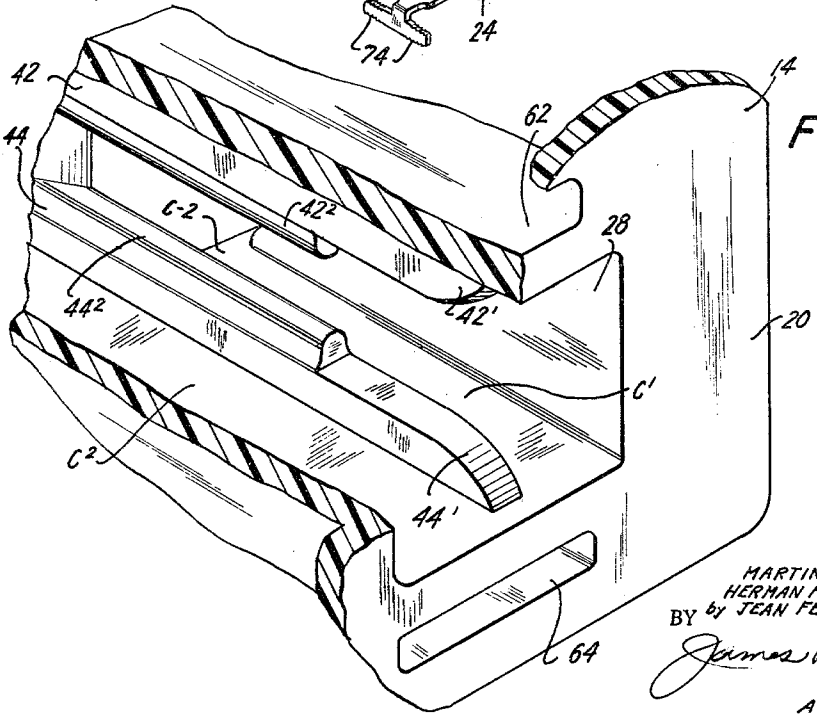


FIG. 3



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Filed July 11, 1962 2 Sheets-Sheet 2

FIG. 4

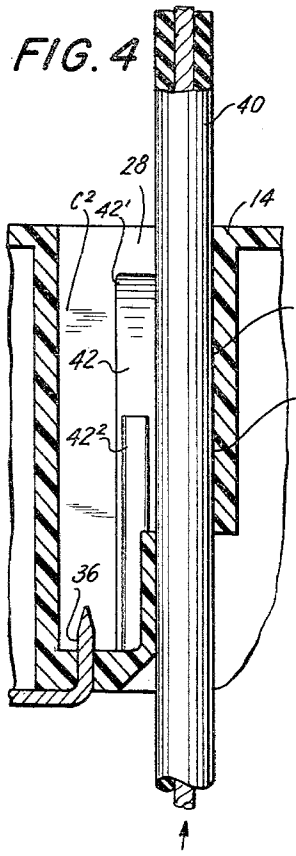


FIG. 5

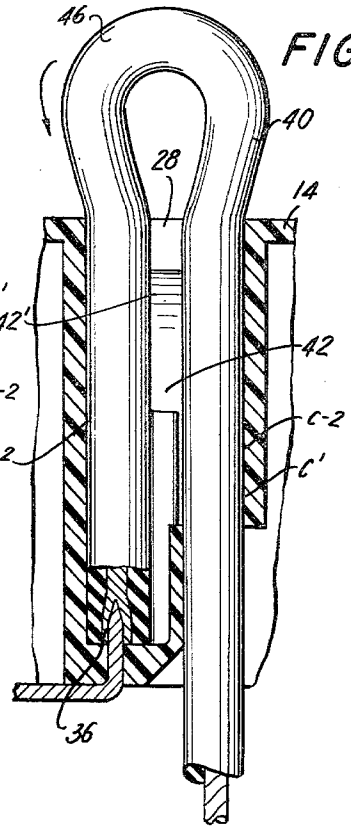


FIG. 6

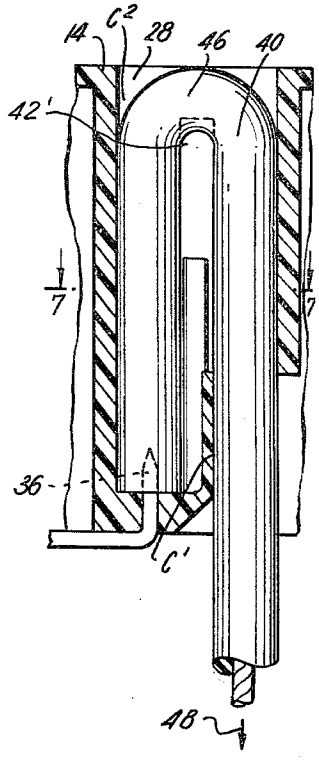
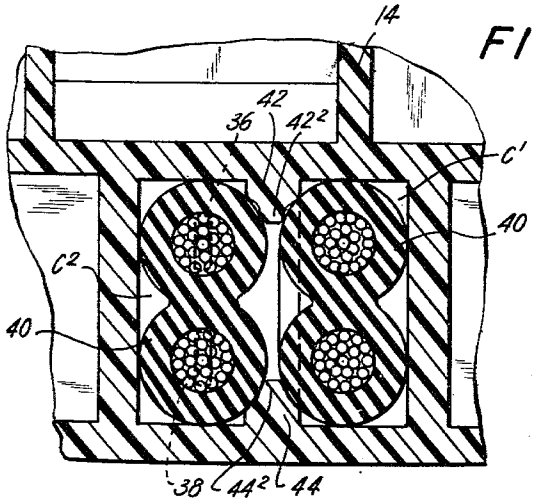


FIG. 7



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3,196,379

ELECTRICAL CONNECTOR

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Filed July 11, 1962, Ser. No. 209,273
3 Claims. (Cl. 339—100)

This invention relates to an electrical connector.

The prime object of the present invention relates to the provision of an improved electrical connector employing principles disclosed in Patent No. 2,675,531, to Martin Sams and Herman Feldman, granted April 13, 1954, and the patent to Saul P. Lippel, No. 2,959,763, granted November 8, 1960.

This type of electrical connector comprises a body containing contact prongs, which form part of the contact terminals of the connector and to which the wires of a duplex cord are to be connected, the said body being formed internally with channels into and through which a duplex cord, the free end of which is merely cut or snipped with a scissors, is moved in such a manner that the exposed wire ends of the duplex cord are forced into the prong contacts for making the necessary electrical circuit connection. The connector thus comprises a unitary element having no movable parts and no securing members (such as binding posts or screws) that require manipulation, attachment of a duplex or multiple wire cord to the connector being achieved merely by the act of inserting the conductor cord into and through the connector channels, the wires or wire strand of the connector being moved into electrical contact and engagement with the connector prongs. There is thus provided a connector, the use of which eliminates the necessity of stripping the wire, or removing the insulation, or fastening the wire by means such as connecting screws, posts or the like, or of providing movable and manipulable elements for bringing the wires into contact engagement with prongs as are required in some of the more modern types of connectors.

In the electrical connectors disclosed in the aforesaid patents, the connector body is formed with two channels or passages, the first a through channel in the body and the second a channel into the inner end of which extend prong contacts, the construction being such that the connector is adapted to receive an insulated wire conductor cord, such as a duplex cord, by moving the cord, with its leading cut or snipped end, through the first channel and thence with a loop bend formed in the cord through the second channel for electrical circuit engagement of the cord conductor ends with the prong contacts. In these patented connectors, the first mentioned channel is produced with a reverse bend, the initial or entrant end of this channel being for this purpose arranged obliquely to the direction of the second channel, it having been found that it was necessary for the cord section lodged in this first channel to have a reverse bend (an S-bend) in order to prevent or minimize loss of electrical contact under a pull-out strain. It has been found, however, that with this construction, under strong pull-out forces exerted on the exposed cord, the cord will creep after loosening of the contact, with the ultimate result of loss of contact. Another difficulty incident to the patented connector of the second mentioned patent has been that conductor cords which may be described as on the "skimpy" side sometimes fail to make the initial contact.

It has now been found that with the reconstruction of the connector in accordance with the present invention, these difficulties are eliminated, principally that the conductor cord even under strong pull-out forces will hold without loss of contact, and the initial contact will be made with the connector prongs for cords of different gauge, even those classed as "skimpy" in size. It has also been found that with the reconstructed connector of the present invention, the connector is better adapted to the making of cube tap connectors, and that the connector body structure is also better adapted for molding techniques.

These improvements are accomplished by arranging the channels in the connector body in parallelism, by spacing the channels in close proximity and in open relation to each other along their mutual or co-extensive lengths and by providing oppositely spaced ridges in the connector body projecting into the space between said channels, said ridges acting or serving as guides for guiding the conductor cord in its movement through the channels.

In the accomplishment of the foregoing objects and such other objects as may hereinafter appear, our invention relates to the electrical connector as sought to be defined in the appended claims taken together with the following description of the invention and the accompanying drawings thereof, in which

FIGURE 1 is a perspective view of a cube tap electrical connector embodying the structure of the invention;

FIG. 2 is an exploded view of the parts of the cube tap connector of FIG. 1 with parts broken away to show the interior construction thereof;

FIG. 3 is a fragmentary view drawn to an enlarged scale with parts broken away and parts shown in cross-section of the front half section of the connector depicted in FIG. 1;

FIG. 4 is a fragmentary view shown on an enlarged scale with parts shown in section taken generally in the plane of the line 4—4 of the connector section half of FIG. 2 of the drawings, FIG. 4 depicting the first stage of the insertion of a conductor cord into said section of the connector;

FIG. 5 is a view similar to FIG. 4 and depicting a subsequent stage in the insertion of the conductor cord;

FIG. 6 is a view similar to FIGS. 4 and 5 depicting a further and final stage of the insertion of the connector cord into the said section of the connector; and

FIG. 7 is a view taken in cross-section in the plane of the line 7—7 of FIG. 6.

Referring now more in detail to the drawings and having reference first to FIGS. 1 and 2 thereof, the principles of the electrical connector of our present invention are shown applied to the making of a cube tap receptacle. This cube tap receptacle comprises a connector body generally designated as 10 made up of two molded sections (of plastic material) 12 and 14 joined together in a plane 16 normal or perpendicular to the length of the connector body and substantially midway between the opposite wall ends 18 and 20 of the body. The connector is completed by the association with molded body sections 12 and 14 of metallic contact means generally designated as 22 and 24 to be described more in detail hereinafter.

The body sections 12 and 14 are molded with the interior configuration as best shown in FIG. 2 of the drawings to provide the various associated cavities therein, and particularly to provide the structure and arrangement of the conductor cord receiving channels above referred to. These channels comprise a first channel C', one part c–1 of which is in the body section 12 and the other part c–2 of which is in the body section 14, this channel C' extending through the body 10 and being open at the opposite end walls 18 and 20 of the body, and a second channel C^2 extending into said body and open only at the body end 20. The opening of the channel C' at the body end wall 18 is designated as 26 and the openings of the channels C' and C^2 at the body end wall 20 merge with each other and define the enlarged opening designated as 28. The inner end of the second channel C^2 is bifurcated by an integral boss part 30 of the body formed with two windows or openings 32 and 34, into which are lodged prong contacts 36 and 38 respectively, these prong

contacts forming an integral part of the metallic connector pieces 22 and 24. When the parts shown in FIG. 2 are assembled, the prong contact 36 extends into the window or opening 32 and the prong contact 38 extends into the window or opening 34, these prong contacts thus extending axially into the inner end of the said second channel C^2. In connecting a conductor cord, such as the duplex cord 40 to the connector, the leading end of the cord is inserted through the opening 26, is moved through the channel C', and the end thereof emerging from the opening 28 is then given a loop bend of 180°, after which the leading end is moved into and through the channel C^2 and into electrical engagement with the impinging prongs 36 and 38, as will be further described hereinafter.

To accomplish the referred to objects, the two resulting branches of the connector cord formed within the connector have to be substantially in parallel and spaced in close proximity to each other. Preferably these cord branches should be contiguous, although they may be separated or spaced slightly from each other. To accomplish this the first and second channels C' and C^2 are arranged in parallelism, are spaced in close proximity, so close that they are open to each other as clearly shown in FIGS. 2 and 3 of the drawings along their mutual or co-extensive lengths. These channels C' and C^2 are, however, separated by oppositely disposed ridges 42 and 44 in the body which project into the open space between the channels.

The channels C' and C2 have a cross-sectional dimension adapted to closely receive the duplex conductor cord. The first channel C' is preferably somewhat larger in cross-sectional dimensions than the second channel to allow for some loose fitting and easy insertion and passage of the duplex cord therethrough, while the second channel is made to receive the cord with a snug fit between the floor of the channel and the ridges 42 and 44 so as to effect a close guiding of the leading end of the cord to the contact prongs. The form or structure of the ridges 42 and 44 is also of importance. The tops 42' and 44' of these ridges, stepped down in formation (see FIG. 3), act to hold the cord firmly against pull-out stress exerted in the direction of the emergence of the cord, while eliminating a tendency to lacerate the cord on a strong pull. The ridges are also provided with secondary ridge portions 42^2 and 44^2, surmounting the main body of the ridges, these serving as an elongation of the step-down portion of the ridges.

This described relationship between the essential elements of the connector and the manner of its use in threading the duplex cord into the connector are depicted in FIGS. 4 to 7 of the drawings in connection with the front half section 14 of the connector body. The connector cord 40 after being moved into the channel part *c*–1 of the connector section 12 (see FIG. 2) is then moved through the channel part *c*–2 of the body section 14, as depicted in FIG. 4 of the drawings, being guided through the channel C' first by the walls of the channel part *c*–1 and then by the walls of the channel part *c*–2 and the ridges 42 and 44. In the next threading step a 180° loop bend 46 is formed in the duplex conductor as shown in FIG. 5 of the drawings, and the leading end thereof is inserted into and moved through the second channel C^2, guided by the walls of this channel and the ridges 42 and 44, the leading end being forced for engagement of the conductor strands of the connector with the prongs 36 (and 38). In the final part of the threading step the conductor 40 is pulled in the direction indicated by the arrow 48 in FIG. 6 of the drawings, which results in the drawing the loop 46 into the opening 28 of the connector and in forcible engagement with the top ends 42' and 44' of the ridges 42 and 44.

Tap contacts for the connector are provided and are formed integrally with the prong contacts 36 and 38. Preferably three sets of such tap contacts are provided

for, one set comprising the contacts 50 and 52, another set being the contacts 54 and 56 and a third set being the contacts 58 and 60. The connector body 10 is formed with plug receiving passages or slots associated with these tap contacts. For the tap contacts 50 and 52 the front section 14 of the body is formed with the plug blade receiving passages 62 and 64 respectively, these passages lying astride the front body opening 28. For the tap contacts 54 and 56 one side of the connector body is provided with the passages 66 and 68 (see FIG. 1), and for the tap contacts 58 and 60 the opposite side of the connector body is provided with the passages 70 and 72 (see FIG. 2).

The parts of the connector are assembled by inserting the metal conductor pieces 22 and 24 into the body section 14 and by then assembling the body section 12 thereto. These parts may be secured together in any desired way; and one means for so securing the same together is provided by the pronged fingers 74, 74 formed integrally with the metal conductor pieces 22 and 24 which take into recesses 76, 76 formed at the corners of the half cubed sections 12 and 14.

The structure and mode of use of our improved electrical connector will be fully apparent from the above detailed descriptioin thereof. With the connector structure of the present invention, the following results and accomplishments are therefore achieved:

(1) The conductor cord is not required to take a reverse or S-bend in order to hold against pull-out; and the connector does not have to be constructed with differently oriented channels;

(2) The elimination of the reverse bend in the first channel, and the reconstructed channel arrangement, permit a very simple design alternative in which the extending connector cord emerges perpendicularly from an end, such as the back of the connector;

(3) Pull-out and creeping loss of contact tendencies are eliminated, even under strong pull-out forces;

(4) Electrical contact with the prongs is assured even with conductor cords of small or "skimpy" gauge;

(5) The connector lends itself to being easily molded in two sections by simple molding techniques; and

(6) A more compact design using less plastic (for a molded unit) and metal is obtained, and one which lends itself efficiently for the making of a cube tap connector as disclosed.

It will be apparent that while we have shown the improved connector of the invention embodied in a cube tap receptacle, the elements thereof may be similarly embodied in other connector types, such as a plug or other form of receptacle connector. It will be further apparent that changes may be made in the construction thereof without departing from the spirit of the invention defined in the following claims.

We claim:

1. An electrical connector comprising a body having opposite end walls, a first channel in said body extending through said body and open at the opposite end walls of said body, a second channel extending into said body and open only at one of said end walls of said body, prong contacts in said body extending axially into the inner end of said second channel, said channels, of cross-sectional dimensions adapted to snugly receive a duplex conductor cord, being arranged in parallelism, spaced in close proximity and being open to each other along their mutual lengths, and oppositely spaced elongated ridges in said body projecting into the open space between said channels, said connector being thereby adapted to receive a duplex conductor cord inserted through said first channel and thence with a 180 degree loop bend through said second channel for electrical circuit engagement with said prong contacts, the said ridges guiding the duplex conductor cord in its movement through said channels, tap contacts, each electrically integral with a prong contact, said tap contacts extending in the same direction as said

prong contacts and towards said one of said end walls, and plug receiving passages for said tap contacts formed in said body at said one of said end walls thereof.

2. The electrical connector of claim 1, in which said body is made of two sections joined together in a plane normal to the length of the connector body and between the said opposite end walls of the body.

3. The electrical connector of claim 1 in which the tap contacts and the plug receiving passages therefor are located astride the said channels.

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