

Aug. 15, 1961

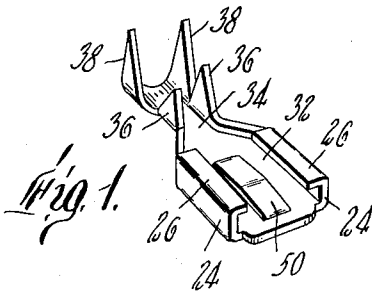
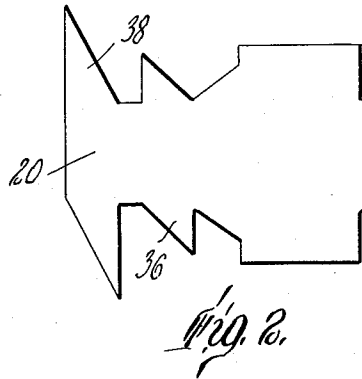
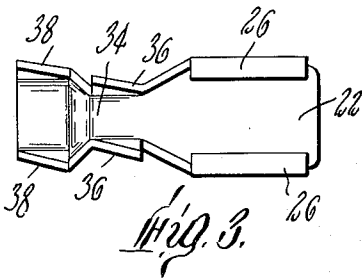
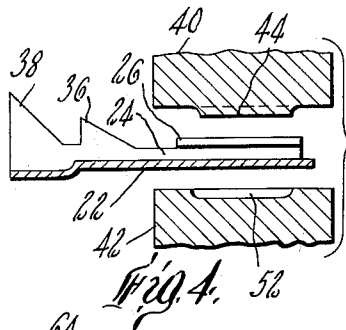
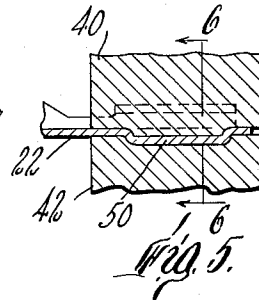
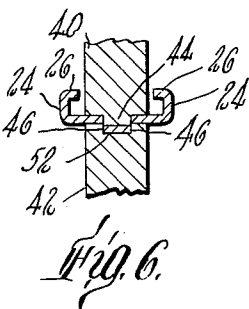
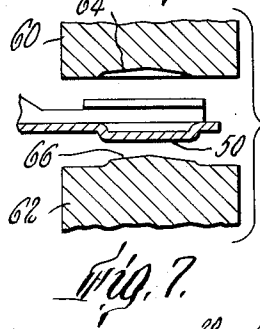
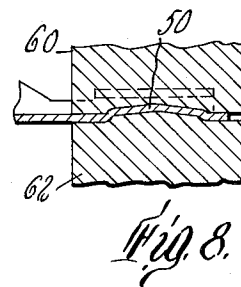
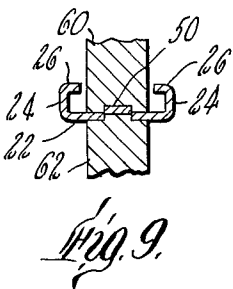
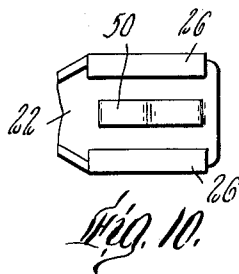
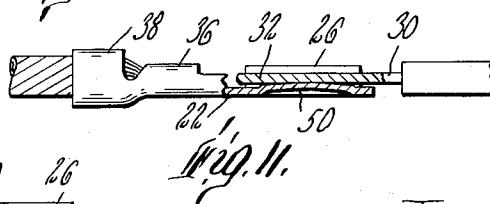
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2,996,026

METHOD OF MAKING AN ELECTRICAL CONNECTOR MEMBER

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2 Sheets-Sheet 1



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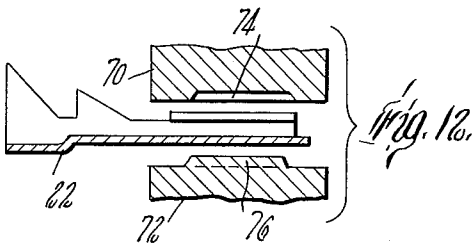
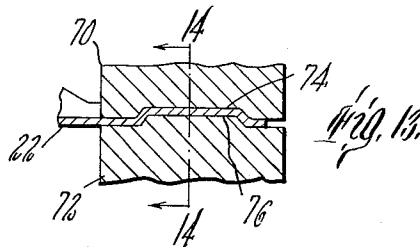
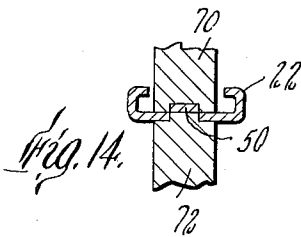
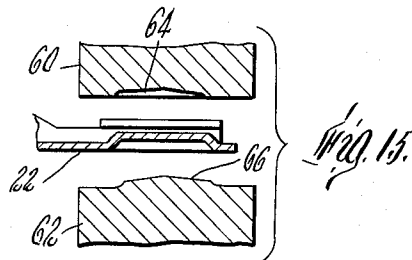
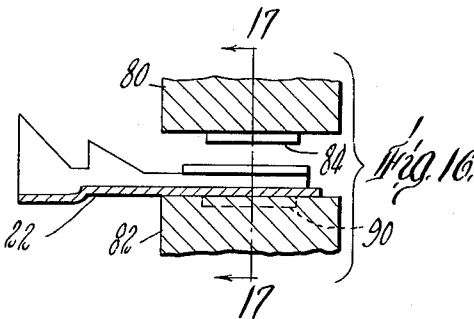
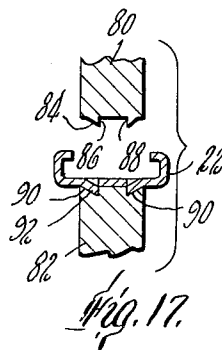
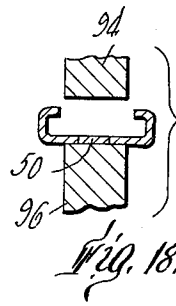
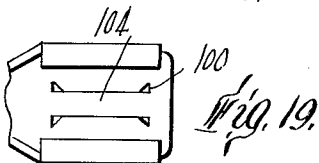
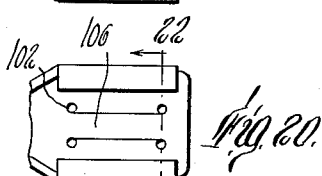
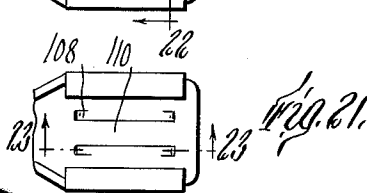
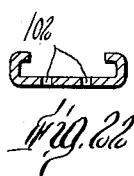
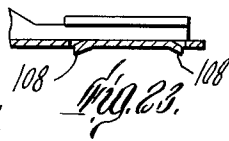
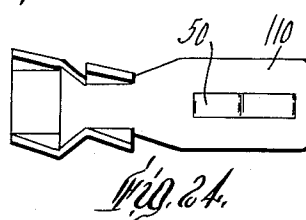
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METHOD OF MAKING AN ELECTRICAL CONNECTOR MEMBER

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2 Sheets-Sheet 2



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2,996,026

METHOD OF MAKING AN ELECTRICAL CONNECTOR MEMBER

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3 Claims. (Cl. 113-119)

This invention relates to an electrical connector member adapted to receive and frictionally grip a complementary member, and to methods of making the same. The member made by said method is preferably the female member of a male-and-female type of connector and consists of a sheet metal blank bent to form a shallow channel with a floor, side walls and inturned flanges on the side walls. The flanges are spaced above the floor of the channel just enough to receive the side margins of the tongue of a male connector member. Two parallel cuts in the floor form a central strip parallel to the side walls. This strip is swaged upward in the form of a wide-angled, inverted V which is slightly above the plane of the remainder of the floor so as to press against the under face of the male connector member which is inserted in the channel. In order to make a good electrical connector, the female member must be capable of receiving the male member in the channel but must press firmly against the under face of the male member the side margins of which are pressed firmly against the under faces of the flanges of the female member. The central strip of the floor must therefore be stiffly yielding. I have found that if the sides of the central strip are completely sheared from the floor for a sufficient distance depending on the thickness and physical qualities of the sheet material of which the member is made, the upwardly swaged strip can be made to yield sufficiently to admit into the channel a male member the margins of which fit closely between the flanges and the floor of the female member.

According to the present invention, the central strip is initially formed by a shearing die which makes two parallel cuts in the floor of the connector member and ensures the complete severance of the metal on either side of each cut for substantially the full length of the cut by displacing the metal at one side or the other of the cut up down for a distance approximately equal to or greater than the thickness of the stock. The resulting central strip is thus provided with sufficient flexibility for the purpose and is thereupon swaged to the desired final form, e.g., a wide-angled inverted V with its central part above the level of the main portion of the floor.

For a more complete understanding of the invention reference may be had to the following description thereof and to the drawing, of which:

FIGURE 1 is a perspective view of a female connector member made by my novel method;

FIGURE 2 is a plan view of a sheet metal blank for a female connector member;

FIGURE 3 is a plan view of a female connector member formed by bending the blank to channel shape;

FIGURE 4 is a sectional view of the member shown in FIGURE 3, together with shearing dies to operate thereon;

FIGURE 5 is a sectional view of said member being sheared by dies;

FIGURE 6 is a section on the line 6-6 of FIGURE 5;

FIGURE 7 is a sectional view of the member and a second set of dies about to perform a swaging operation;

FIGURE 8 is a sectional view of the member and second dies after they have come together;

FIGURE 9 is a sectional view, in another plane, of the member and dies shown in FIGURE 8;

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FIGURE 10 is a plan view of the completed member; FIGURE 11 is a side elevation, partly broken away to show in section, of a complete connector including a member such as is shown in FIGURES 1 and 10;

FIGURE 12 is a sectional view of the member shown in FIGURE 3 with shearing dies of a modified form about to operate thereon;

FIGURE 13 is a sectional view of said member being sheared by the dies shown in FIGURE 12;

FIGURE 14 is a section on the line 14-14 of FIGURE 13;

FIGURE 15 is a sectional view of the connector member sheared as shown in FIGURE 14, together with swaging dies to shape the central strip;

FIGURE 16 is a sectional view of a connector member and another modification of shearing dies;

FIGURE 17 is a section on the line 17-17 of FIGURE 16;

FIGURE 18 illustrates the step of restoring the displaced portions of the floor to the plane of the floor;

FIGURE 19, 20 and 21 are fragmentary plan views of connector members having parallel cuts in the floor, the ends of the cuts being defined by previously made apertures or struck-up elements;

FIGURE 22 is a section on the line 22-22 of FIGURE 20;

FIGURE 23 is a section on the line 23-23 of FIGURE 21; and

FIGURE 24 is a plan view of a male connector member having a yielding element embodying the invention.

The initial steps of forming a female connector member are conventional and consist of cutting out a metal blank 20 and bending portions of it to form a shallow channel having a plane portion or floor 22, side walls 24 along the side edges of the floor, inturned flanges 26 which project toward each other from the upper edges of the side walls 24 and overhang the side margins of the floor 22. The flanges 26 are spaced above the floor just sufficiently to receive the side margins of a male connector member 30 which comprises a plane tongue 32 having a width nearly equal to the distance between the side walls 24. Extending from an end of the floor 22 is a neck 34 from which two pairs of fingers 36 and 38 are bent up to receive the end portion of an insulated wire, the fingers 36 being adapted to be wrapped around and to grip the bared end portion of the wire itself, the fingers 38 being adapted to be wrapped around and to grip the insulation adjacent to the bared end of the wire.

According to the present invention, the member, formed as shown in FIGURE 3, is operated on by complementary shearing dies such as the dies 40 and 42 shown in FIGURES 4, 5 and 6, to form a raised element in the floor thereof. The upper die 40 has a low boss 44 which is about the same thickness as the stock of which the connector is made. The boss 44 is rectangular in shape, having sharp, parallel side edges 46 which are adapted to make shearing cuts in the floor of the channel to form a central strip 50 in the floor, the ends of the strip merging integrally with the floor itself near the ends thereof. Cooperating with the upper die 40, the lower die or anvil 42 has a depression 52 with dimensions similar to those of the boss 44. When a connector member is died as shown in FIGURE 5, parallel shear cuts are made in the floor, the cuts being substantially as long as the side edges 46 of the boss 44. The strip 50 which is formed by the cuts is displaced downward a distance equal to the thickness of the boss 44, that is, preferably about equal to the stock thickness of the metal of which the connector member is made. This ensures a complete separation of the opposed edge faces created by each of the shear cuts.

After removal from the dies 40 and 42 the connector member is placed between a pair of dies 60 and 62.

The upper die 60 has an elongated recess 64 having the same length and width as the recess 52 in the anvil 42. The recess 64, however, is of varying depth, the bottom of the recess sloping gradually from a maximum midway between its ends to minima at the ends. A complementary boss 66 is on the face of the lower die or anvil 62. When the connector member having shear cuts forming a strip below the level of the floor is operated on by dies as shown in FIGURES 7 and 8, the strip is forced upward to project above the level of the floor and is swaged to the shape of a wide-angled inverted V. When a male connector member is inserted in the channel, its leading end rides on one flank of the inverted V and forces the strip downward, the length of the strip and its completely sheared side edges being sufficient to permit the yielding of the strip which is necessary for the entry of the male member.

The initial cuts which form the central strip need not necessarily be made by forcing the strip below the level of the main portion of the floor. An alternative method is to force the strip up above the level of the floor sufficiently to cause a complete separation of the edges of each cut for substantially the entire length of the cut. Thus a pair of dies 70 and 72 may be employed to make shearing cuts in the floor of a connector member 22, the upper die 70 having an elongated recess 74, and the lower die 72 having a complementary boss 76 arranged to make two parallel shearing cuts and to displace the strip between the cuts upward for substantially its entire length a distance as great as the stock thickness of the metal to effect a complete separation of the edges on opposite sides of each cut for substantially the entire length of the cut. The central strip thus formed is then swaged to its final shape by dies 60 and 62 as indicated in FIGURE 15, these dies being the same as those illustrated in FIGURES 7 and 8.

In the shearing operations hereinbefore described, the central strip formed by the cuts has been displaced from the plane of the floor. An alternative method is to displace upward or downward portions of the floor adjacent to the strip so as to complete the shear for substantially the entire length of each cut. For this purpose, dies 80 and 82 as shown in FIGURES 16 and 17 may be employed. The die 80 has parallel blades 84 with triangular cross-section, the mutually opposing faces 86 and 88 of the blades being in parallel planes. The die 82 has two complementary grooves 90 directly under the blades to receive portions 92 of the floor of the connector member 22 which are forced down by the blades in the shearing operation while the resulting central strip 50 is supported in the plane of the floor by the die surface between the grooves 90. The depth of the grooves 90 is substantially equal to the stock thickness of the metal of the member 22, so that the severance of the metal along the entire length of each cut is complete. After the cuts have been made as described, the member may be operated on by dies 60 and 62, as in FIGURE 15, to restore the bent-down floor portions 92 to the level of the floor and to swage the central strip 50 to its final shape. If preferred, this may be done in two steps, the bent-down portions 92 being first flattened by plane dies 94 and 96 as indicated

in FIGURE 18 before the dies 60 and 62 are employed to swage the central strip 50.

In order to make the effective length of the central strip more definite and exact, four holes may be punched in rectangular array in the floor to mark the ends of the two cuts which are preferably made afterward. The four holes may be triangular as shown at 100 in FIGURE 19, or round as shown at 102 in FIGURE 20. Cuts connecting pairs of the holes may then be made by any of the three methods hereinbefore described to form a sufficiently flexible central strip 104 or 106. Instead of punching holes, tabs 108 may be struck up as indicated in FIGURES 21 and 22 to determine accurately the effective length of the cuts subsequently made to form the central strip 10.

While the central yielding strip 50 is preferably formed in the floor of a female connector member, it may instead be formed in the plane portion or tongue 110 of a male connector member by any of the methods hereinbefore described. The male member thus formed with a resilient center strip can be used with a female member having a plane floor as illustrated in FIGURE 3, but the tongue 110 of the male member must be inverted so that the raised strip 50 will bear against the floor 22 of the female member.

I claim:

1. A method of making a raised element in a metal electric connector member having a plane portion, which comprises making two parallel shearing cuts in said plane portions to form a central strip therein, displacing said strip downward for substantially its entire length below the level of the plane portion a distance as great as the stock thickness of the metal, and thereafter swaging said central strip to a wide-angled inverted V shape projecting above the level of said plane portion.

2. A method of making a female connector member, which comprises bending a sheet metal blank to form a shallow channel with a plane floor, parallel side walls rising from the side edges of the floor, and intumed flanges along the top of the side walls, dieing the central portion of said floor to make two parallel shearing cuts and to force the strip thus formed between the cuts downward for substantially its entire length, and then swaging said strip upward to project above the level of the floor, the highest point of the strip being approximately midway between its ends.

3. A method as in claim 2, the strip when formed being displaced downward throughout substantially its entire length a distance approximately equal to the stock thickness of said blank.

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