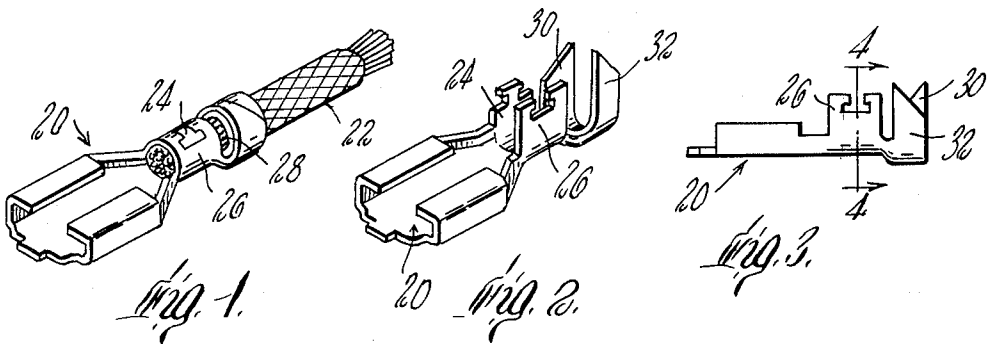
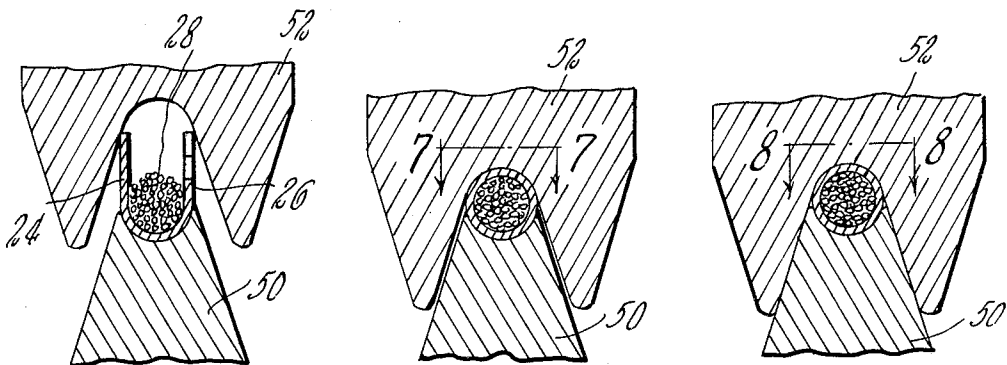
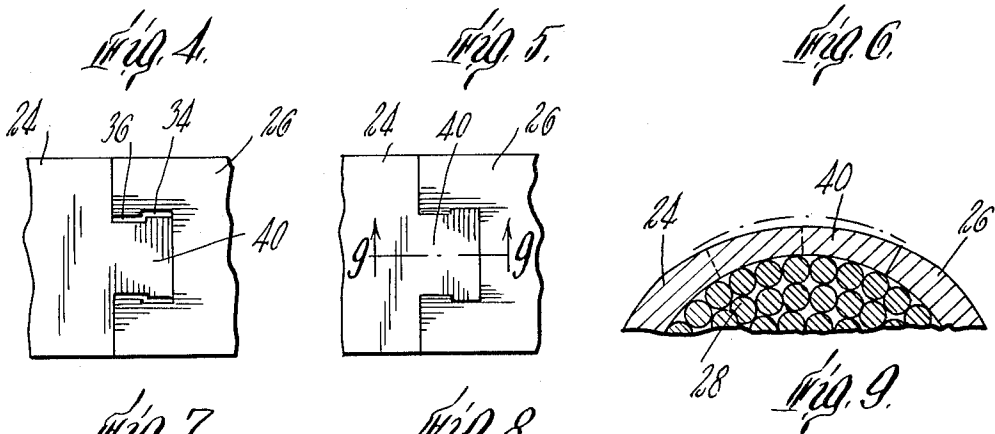
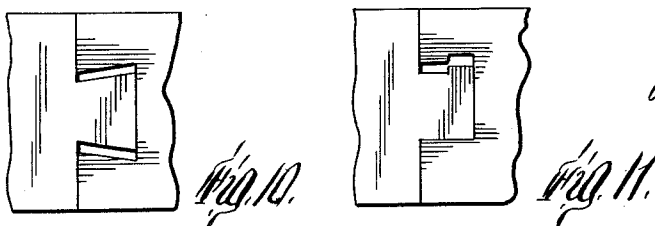


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WIRE GRIPPING ELEMENTS AND METHOD OF  
MAKING AND CRIMPING SAME  
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## WIRE GRIPPING ELEMENTS AND METHOD OF MAKING AND CRIMPING SAME

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This invention relates to wire-gripping elements of an electric connector or other object to be secured to the wire and a method of making and crimping the same. It has long been the practice to provide opposing tongues of metal to be curled about the end portion of a wire and crimped into the form of a tubular ferrule. Owing to the natural resilience of the metal—which is usually brass—there is always a slight tendency on the part of the curled tongues to relax a bit, this tendency being more pronounced when the tongues are made of the lighter gauges of metal. It is important for a good electrical connection that a strong interfacial pressure be maintained between the surfaces of the wire and the ferrule which are in mutual contact. According to the invention, this high degree of interfacial pressure is maintained by interlocking the ends of the tongues of metal which are crimped around the wire to form the wire-gripping ferrule. The interlock is formed by providing in the end of one tongue a recess which is wider at its inner end than at the extremity of the tongue, and a projection on the end of the other tongue which is wider at its extremity than at its junction with the body of the tongue. In the crimping operation the projection is made to enter the recess endwise whereupon the end portions of both tongues are struck with sufficient force to flatten the metal considerably and to cause it to flow laterally to fill the spaces between the edges of the recess in one tongue and the edges of the projection at the end of the other tongue. The result is a positive interlock which does not yield or relax, the wide extremity of the projection being thus swaged to fill the wide inner end of the recess.

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 an electric connector member mounted on the end portion of an insulated wire, said member having a wire-gripping ferrule embodying the invention;

FIGURE 2 is a perspective view of the connector member shown in FIGURE 1 prior to being mounted on a wire;

FIGURE 3 is a side elevation of the member mounted on a wire;

FIGURE 4 is a sectional view of a die and anvil, the latter having thereon a connector member ready to be crimped about a wire, the section of the member being on the line 4-4 of FIGURE 3;

FIGURES 5 and 6 are sections similar to FIGURE 4 but show the parts in successive stages of operation;

FIGURE 7 is a fragmentary plan view of the end portions of the tongues forming the ferrule, prior to swaging, seen as indicated by the line 7-7 of FIGURE 5;

FIGURE 8 is a fragmentary plan view as indicated by the line 8-8 of FIGURE 6, showing the interlocked ends of the ferrule tongues after being swaged;

FIGURE 9 is an enlarged fragmentary sectional view on the line 9-9 of FIGURE 8;

FIGURES 10 and 11 are fragmentary plan views, similar to FIGURE 7, of modified forms of interlocking ferrules.

FIGURE 1 illustrates a member of an electric connector 20 which is attached to an insulated wire 22. The

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member 20 is made of sheet metal, usually soft brass, and has wire gripping elements consisting of two tongues 24 and 26 which are wrapped around the bared end portion 28 of the insulated wire. The wire gripping portion of the connector member also has a pair of tongues 30 and 32 which are to be wrapped around the insulation of the wire adjacent to the bared end portion 28 as illustrated in FIGURE 1. It is important that when the tongues 24 and 26 are crimped around the wire portion 28, the wire portion be tightly and permanently squeezed so as to make a good electrical connection. A well designed crimping machine will crimp tongues of the type similar to the tongues 30 and 32 tightly about a wire, but when the pressure of the crimping apparatus is released, the natural resilience of the metal usually causes the tongues to relax slightly. This reduces the interfacial pressure between the inner surfaces of the tongues and the surfaces of the wire itself. The chief purpose of the present invention is to provide interlocking means which will operate reliably in the crimping operation and will serve to hold the tongues which are crimped about the wire permanently in tightly pressing engagement with the wire. For this purpose a recess is formed in the end of one of the tongues and a projection of approximately the same shape as that of the recess is formed on the end of the other tongue. The recess is such a shape that the maximum width is at its inner end, the maximum width of the projection on the other tongue being at its extremity. In order to facilitate the crimping operation, the maximum width of the extremity of the projection is slightly less than the maximum width of the recess so that the projection can be inserted endwise in the recess by movement of the ends of the two tongues toward each other in the same plane. One form of interlock is shown in FIGURE 7, this consisting of a T-shaped recess 34 extending in from the end of the tongue 26, the portion of maximum width of the recess being at its inner end. The recess thus consists of a wide longitudinal slot extending in from the end of the tongue and having an inner portion of greater width which can be considered as the transverse portion of the T. The complementary element is a T-shaped projection 40 on the end of the tongue 24, this projection having a shape approximating that of the recess 34. The extremity of this projection is its widest part. This extremity is slightly less in width than the slot 36 of the recess 34 so that it can enter endwise through the longitudinal slot 36 to the position shown in FIGURE 7. The length of the projection 40 is preferably equal to the length of the recess 34 so that when the projection is inserted in the recess as shown in FIGURE 7, the end edges of the two tongues will abut each other. This will leave narrow areas of clearance between the sides of the projection 40 and side edges of the recess 34. When the two tongues have been brought together in abutting relationship, the projection 40 and the metal adjacent to the recess 34 are cold-forged or swaged to flatten these portions of the tongues (FIGURE 9) sufficiently to spread such metal laterally so as to fill the crevices between the projection 40 and the edges of the recess 34 as indicated in FIGURE 8. This forms a positive interlock between the ends of the tongues at the moment when the pressure of the tongues upon the wire which the tongues surround is at its maximum. The wire gripping portion of the electric member consequently cannot relax but is permanently held in tightly gripping relationship to the wire which it surrounds.

Other shapes of interlocks can be employed such as the keystone or dovetail shape illustrated in FIGURE 10 and the L-shape in FIGURE 11. In both of these cases the maximum width of the recess is at the inner end thereof.

In FIGURES 4, 5 and 6 an anvil 50 and die 52 for the crimping of the tongues about the wire are shown in suc-

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cessive steps of operation. The wire-gripping portion of the connector member 20 is placed on the grooved top of the anvil 50, the tongues 24 and 26 extending upward as shown to receive the end portion 28 of the wire between them. The die then descends as shown in FIGURE 5 to crimp the tongues into a cylindrical form, the projection 40 moving endwise into the recess 34 until the end edges of the tongues meet as indicated in FIGURE 7. The die 52 then moves a little further downward to the position shown in FIGURE 6. This has the effect of imposing great interfacial pressure between the wire-gripping portion of the electric member and swages the projection 40 and the end portion of the tongue 26 adjacent to the recess 34 so as to complete the interlock as illustrated in FIGURE 8. This forms a permanently tight connection between the connector member 20 and the wire which it grips.

I claim:

1. A method of joining together two metal strip ends, which comprises forming a recess in one said end, said recess being widest at its inner end, forming a projection on the other said end approximately the same shape as said recess and widest at its extremity, the widest part of said projection being slightly narrower than the narrowest part of said recess, moving said ends edgewise into mutual engagement with the projection within said recess, and cold-forging said projection and the metal adjacent to said recess by striking on the faces thereof to flatten and spread said projection and adjacent metal sufficiently to fill the clearance between the edges of said projection and the edges of said recess.

2. A method as described in claim 1, including the steps of making a T-shaped recess in one said end and a T-shaped projection on the other said end.

3. A method of crimping the wire-gripping portion of an electric element about a wire, which comprises shaping said wire-gripping portion in the form of two tongues

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with a recess in the end of one of said tongues which varies in width and is widest at its inner end and a projection on the end of the other tongue which is shaped approximately like said recess but is narrow enough to enter said recess by movement in the same plane, curling said tongues about said wire so that said projection enters edgewise into said recess, and cold-forging said projection and the metal adjacent to said recess by striking on the faces thereof to flatten and spread the same so as to close the clearance between the edges of the projection and the edges of the recess.

4. An electric element of sheet metal adapted to be mounted on the end portion of a wire, said element having a wire-gripping portion comprising oppositely extending tongues adapted to be curled around a wire to grip the same, one of said tongues having a T-shaped recess in the end thereof, said recess consisting of a slot extending in from the end of said tongue with a widened inner end, the other said tongue having a T-shaped projection extending out from the end thereof the length of said recess being substantially equal to that of said projection, the maximum width of said projection being slightly less than the minimum width of the slot.

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