

Aug. 23, 1955

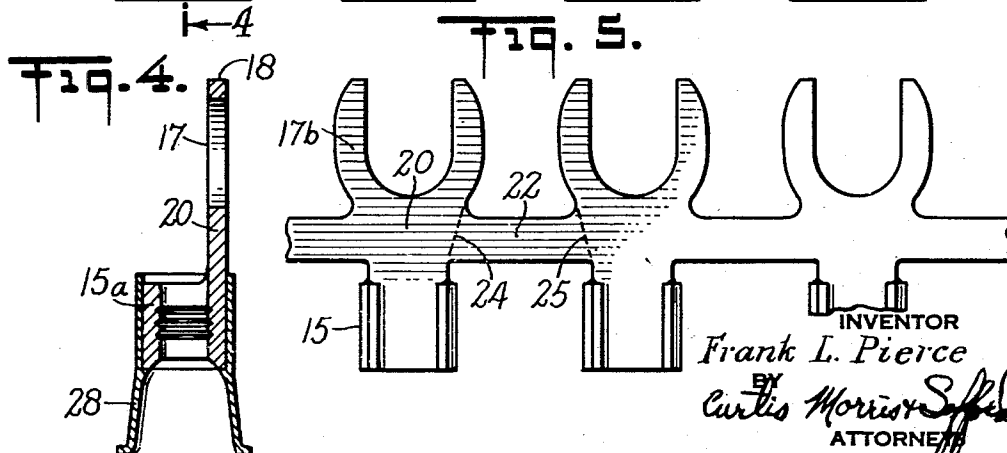
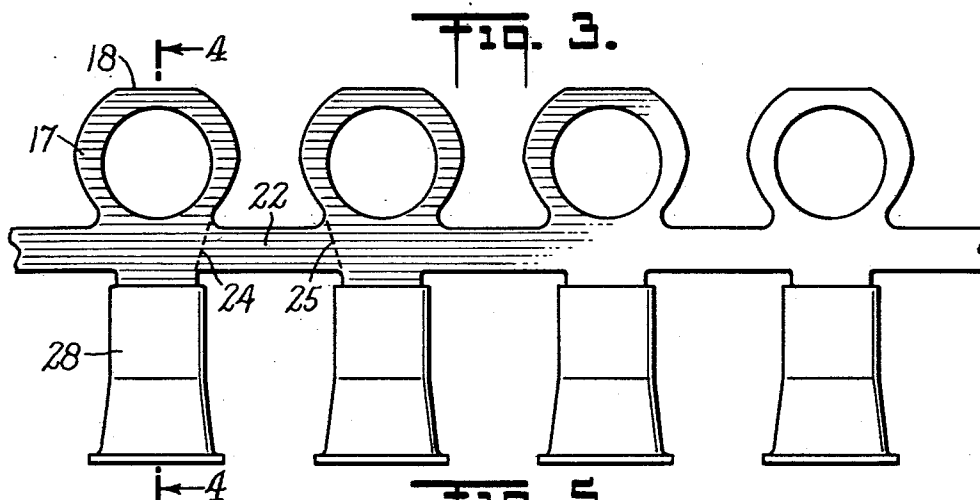
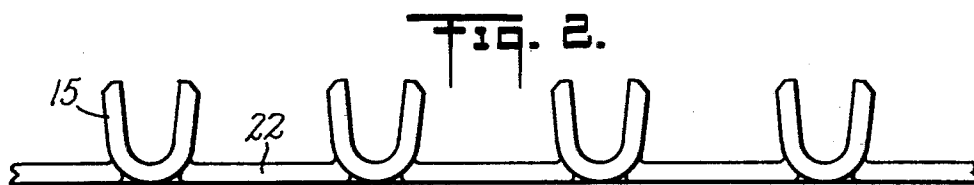
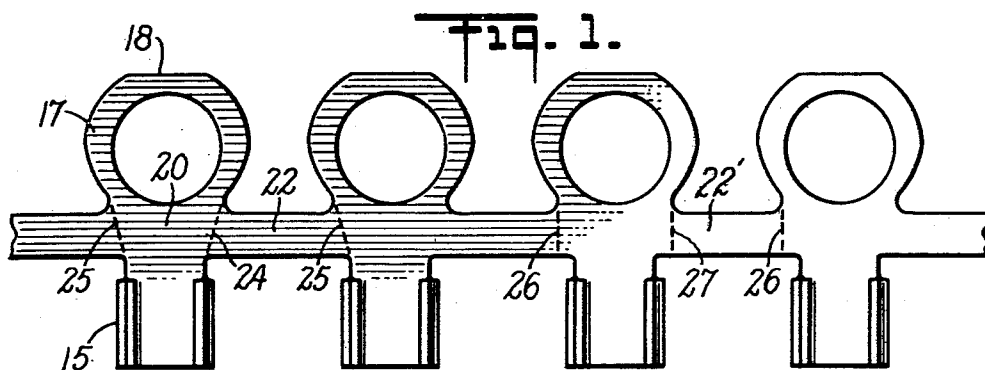
F. L. PIERCE

2,715,764

METHOD OF APPLYING CONNECTORS TO CONDUCTORS

Filed April 22, 1954

2 Sheets-Sheet 1



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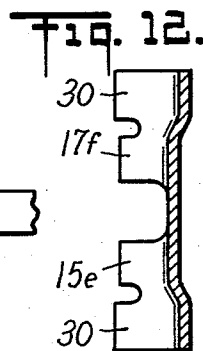
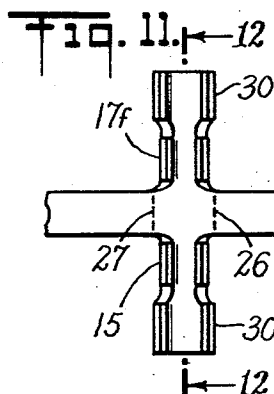
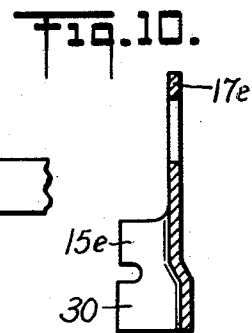
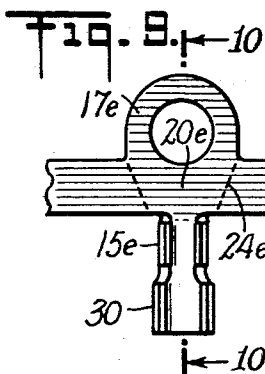
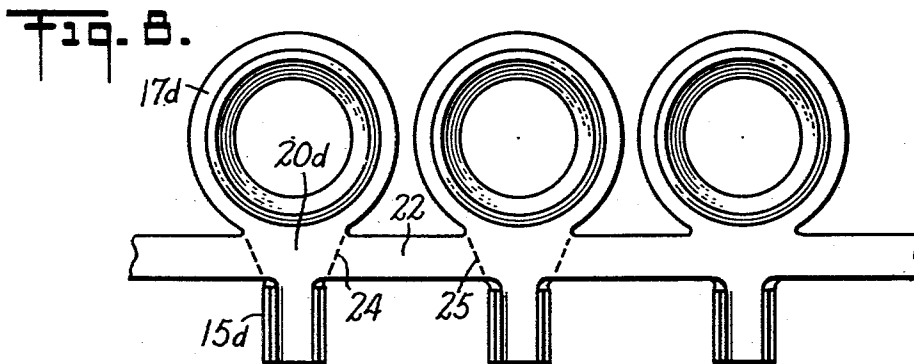
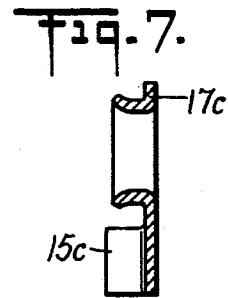
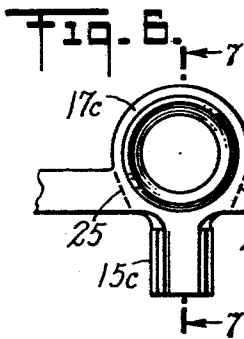
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2,715,764

METHOD OF APPLYING CONNECTORS TO CONDUCTORS

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2 Sheets-Sheet 2



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2,715,764

METHOD OF APPLYING CONNECTORS TO CONDUCTORS

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Application April 22, 1954, Serial No. 424,888

3 Claims. (Cl. 29—155.55)

This invention relates to a method of applying connectors to wires, including the various kinds of conductors for leading current to electrical apparatus and to electrical connectors and more particularly to strip connectors for application by machines which feed the strip automatically so as to bring connectors of the strip successively into position for application and which sever each connector thus positioned and crimp it or otherwise secure it onto the wire and is a continuation-in-part of copending application Serial No. 144,293, filed February 15, 1950, now abandoned, which in turn is a division of copending application Serial No. 47,281, filed September 1, 1948, now abandoned.

Prior to my invention such connector applying machines and strips of connectors for use in such machines have been very successfully developed and brought into wide use with consequent savings in manufacture of electrical products and concomitant improvement in quality. Such machines were first disclosed in the patent of Vernon E. Carlson No. 2,396,913. It has been generally felt, however, that this saving could be available only for items manufactured in mass production with very large numbers of identical connections, because with each different connection it has been necessary to design and build a special machine to give a feeding distance at each step exactly equal to the unit dimension of the connectors in the strip and with special cut-off dies for severing the individual connectors as they come successively into the applying position. It has been found uneconomical and practically impossible to standardize on any single size and design of connector; and hence it has been accepted as inevitable that such special machines must be used for different applications.

The present invention takes advantage of the fact that, although there are wide variations in the over-all length of connectors and wide variations in the width of the contact tongue or other second contact portion, the ferrule portions, by which contact is made with the wire, are quite uniform, particularly for each standard size (or range of sizes) of wire. Although this uniformity in width of the ferrule-forming portions has existed, it was thought that this could be of no benefit because it is ordinarily undesirable to connect the side edges of the ferrule portions of adjacent connectors and moreover, the ferrule portion ordinarily must be in a crimping die at the applying position so that it complicates the machine to sever the connectors in that portion.

It is an object of the present invention, therefore, to solve this problem, to make the use of terminal applying machines more widely applicable in electrical manufacturing and to make the use of such machines more economical in the smaller volume applications and thus to reduce the cost and to improve the quality of products requiring special connections which are not used in the largest volume production. Another object of the invention is to reduce the number of machines required by a manufacturer who uses several different types of connections in his products and thus, again, to reduce his over-

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head costs, and likewise making it feasible for smaller manufacturers to use machines successively to apply by machine all of their various connectors, although their volume on any one of them would not be sufficient to justify the use of a machine.

Another object of the invention is to provide a connector strip which is highly resistant to damage by accidental twisting or excessive bending.

According to the present invention, the successive connectors in the strip are joined by standardized tying links in a zone which passes just beyond the end of the ferrule-forming portion, and such links are severed with uniform length and on lines at each end which are standard for an entire set of different connector strips.

In the accompanying drawings are shown, and in the following description there are described, certain preferred embodiments of the invention and various alternatives and modifications. It is to be understood that these are not intended to be exhaustive or limiting of the invention, but on the contrary are given for the purpose of illustrating and explaining the invention and the principles thereof and how it may be employed in practical use, so that other skilled in the art may be enabled to apply it and adapt and modify it to various forms, each adapted to the conditions of a particular use. In these drawings:

Figure 1 is a plan view of a short section of a connector strip according to the present invention;

Figure 2 is a view of the same in elevation taken from the bottom of Figure 1;

Figure 3 is a plan view similar to Figure 1 but showing another embodiment having a different form of ferrule portion;

Figure 4 is a view in section taken on line 4—4 of Figure 3;

Figure 5 is a plan view similar to Figure 1 but showing another embodiment having a different form of second contact portion;

Figures 6, 8, 9 and 11 are fragmentary plan views showing other embodiments of the invention, and

Figures 7, 10 and 12 are views in longitudinal section taken respectively on lines 7—7 of Figure 6, 10—10 of Figure 9 and 12—12 of Figure 11.

Referring first to Figures 1 and 2, the connectors there shown have a U-shaped ferrule portion 15 which, in the applying station of the applying machine, is curled over and closed back into gripping and contacting relation to a wire inserted into the U. This may advantageously be performed by dies and methods as more particularly shown and claimed in the copending applications of James C. Macy, Serial Nos. 717,842 and 679,630, filed respectively December 23, 1946, and June 27, 1946, or by other known methods and apparatus. The second contact portion 17, adapted to make contact with, and thereby to connect, the wire to a binding post or like conductive element is shown in this case as a conventional ring tongue, except that a portion of the outer end 18 is omitted to economize on the width of stock required for stamping the strip. Since this outer end does not have to carry much current and is not subjected to any but tensile stresses, it is not required to be as heavy as other parts of the terminal, so that this economy detracts nothing from the quality and utility of the terminal.

Between the ferrule forming portion 15 and the second contact portion 17 is an intermediate connecting or neck portion 20 which lies at the base of the second contact portion and just beyond the end of the ferrule portion. Extending laterally from each side of this intermediate portion, and integral with it so as to form a continuous strip in this zone, are the tying links 22.

As will be evident from Figure 1, there need not be any sharp demarcation in the strip between the several portions mentioned. The intermediate portion within

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the same zone as the tying links 22 may overlap, or even lie wholly in the area of the second contact portion. Thus as shown in Figure 1, nearly half of the intermediate portion would lie on a binding post or under a contact screw, serving to give electrical contact. In the same way the boundary between the connector and the links 22 is not sharply fixed except by the design of the dies used to sever the individual connectors. This is illustrated on Figure 1 by the broken lines 24 and 25 at the left hand side of the figure and 26 and 27 at the right of the figure. The former are sloping so that the links 22 when knocked out by the severing die are trapezoids and the resulting connectors have smoothly continuous edges; whereas if the dies sever the links at right angles as shown at the right of the figure the resulting slugs 22' would be rectangular and corners are left on the connectors. The end lines left by the cut-off dies may also be curved or angular. It is not essential to the invention which of these or what other lines are followed in severing the connectors, but it is important that the length of the slug 22, the form of its ends and the width of the intermediate portion in the zone between the tying links, are standardized and kept uniform for all strips used with a given machine.

According to the invention, the width of the intermediate portion may be approximately the minimum required for the largest connector to be used with the machine and this is kept the same for all smaller connectors. The length of the link is made sufficient to accommodate the largest tongue or contact portion and the largest ferrule portion in any connector to be used with the machine and is kept the same for all smaller connectors. Thus any desired variations may be permitted in the size and form of the ferrules and second contact portions. It is not essential however, that the width or thickness of the tying links be the same. With smaller connectors, thinner and/or narrower links may be desirable, and these can be cut off by the same dies as the larger ones, merely using less than the full cutting edge and less than the full stroke of the cut off dies.

Such variations are illustrated in Figures 3 to 12. The strip of Figures 3 and 4 is similar to that of Figure 1 except that the ferrule portion, which was U-shaped in Figure 1, is shown as cylindrical and closed to a butt seam and is fitted with an insulating sleeve 28 in Figures 3 and 4. In Figure 5 the ferrule is like that of Figure 1 but the second contact portion is of the so-called spade tongue type. Figures 6 and 7 show a strip of the type described and claimed in a copending application Serial No. 11,082, filed February 26, 1948. In this case it is important to have the ferrule as close as possible to the center of the second contact portion 17c and hence the latter is largely within the zone 20 between the links 22. Figure 8 illustrates a connector with a very large ring tongue so that the tongues almost touch one another in the strip. In the case shown in Figure 9 a wider link 22e is used, but the length of links 22e and the cut off dies for severing the links at 24e and 25e remain the same. Figures 9 to 12 show a different type of ferrule having a contact portion 15e for crimping or otherwise making electrical contact and mechanical connection with a bared end of an insulated wire and an insulation support portion 30. In Figures 11 and 12 second contact portion 17f is a ferrule identical with the ferrule portion 15e and is likewise provided with an insulation support portion 30. In this figure the square cut off lines 26, 27 are indicated as at the right of Figure 1.

Corresponding parts in these several figures are designated by the same reference numerals, and variants are distinguished by letters added to the numerals.

As stated above, this strip may be applied by any transverse feed terminal applying machine, e. g. such as is shown and described in the Carlson Patent 2,396,913, merely shifting the location of the cut off dies and slug ejector relative to the crimping dies and feeding mechanism

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to accommodate the central location of the links 22. It is also desirable to feed by a reciprocating pawl engaging the edge of the connectors, between the links 22 and the ferrule portions 15, as this edge may be kept at uniform spacing for all the various connectors of a set of different strips. If the sprocket feed of the patent is used, the sprocket would have to be provided with conical teeth and be spring pressed against the strip to give engagement in different sized holes of different connectors; or the sprocket wheels would have to be changed for different holes, as the crimping dies have to be changed for different ferrules. Since the links 22 and the neck portions 20 are always equal in length, it follows that all parts of each connector of any of the strips illustrated in the drawings lie an equal distance from the corresponding parts of the adjacent connector. Hence, the feed of the strips through any machine in which they may be subsequently processed is standardized, for regardless of where the feeding mechanism engages the strip, its stroke will be of constant magnitude.

Although the shape and size of the connecting links is not critical for the invention in its broadest aspect, provided only that the cut-off lines and their spacing are uniform for the successive connectors of every strip in the set which is to be used in any single machine, it is highly advantageous to make the tying links, as shown in the drawings, the weakest part of the strip. Thus any stresses which would tend to deform the connectors in the strip are relieved by yielding of the links 22, and the connectors themselves are thus effectively protected by the links. The links 22 being narrow and straight, are readily bent back into alignment after such distortion by stresses exerted on the strip. It is also an advantage of the structures shown that the links join the connectors in the intermediate zone 20, which is the strongest part of the connector and the one which would least interfere with the proper functioning of the connector if it should be bent to some extent. This is an important departure from previous practice wherein it has been customary to join the successive connectors in the strip directly at a central portion of their contact tongues, which is often the part most easily deformed and one which it is important to keep in its intended shape and to avoid deformation.

The invention also makes feasible the inclusion of a sequence of different connectors as an integral set in the same strip. Thus, for example, a ring tongue and a spade tongue alternate in the strip so that a wire can be put into the machine and have a ring tongue connector applied to one end, then reversed and inserted to have a spade tongue connector applied on the next operation.

It will be noticed also that in the set of connector strips shown in the several figures of the drawings the ferrule is always in substantially the same relation to the tying zone 20, 22 so that the various strips can all feed their ferrules into crimping dies, at the same location in the machine. Likewise the base of the contact portions where they join the connecting zone 20, 22 has a uniform spacing so that its edge can serve for indexing or gauging the strip to position it relative to the cut-off dies and to the crimping dies and to the station where the wire is inserted.

Thus it will be seen that the present invention provides a novel strip, which is an important advance in the art when considered per se, and is even more important when a variety of such strips for different connectors are considered as a set.

What is claimed is:

1. In the art of putting various kinds and sizes of electric terminals on wires, said terminals, although being of various kinds and sizes, having in common a ferrule portion, a contact portion, and an intermediate neck between said ferrule and said contact portions, that improvement which includes the steps of:

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forming a first strip of terminals arranged in transverse side-by-side disposition with means connecting the necks of successive terminals to maintain them spaced apart, said first strip being characterized by uniformity in the linear distance from a point on the neck of a terminal to a corresponding point on the neck of the next successive terminal, independent of the size and shape of said terminals, intermittently feeding the terminals of said first strip successively to a crimping point starting with the leading end terminal with a feed stroke equal to said uniform linear distance between corresponding points on the necks of successive terminals, crimping said terminals onto wires at said crimping point, forming a second strip of terminals having different dimensions from those of said first strip, said second strip being characterized by the same uniformity in the linear distance from a point on the neck of a terminal to a corresponding point on the neck of the next successive terminal, independent of the size and shape of said terminals to adapt it for the same feed stroke as the first strip, intermittently feeding said second strip of terminals successively to said crimping point starting with the leading end terminal with a feed stroke equal to said uniform linear distance between corresponding points on the necks of successive terminals, and crimping said terminals of said second strip onto wires at said crimping point.

2. In the art of crimping various kinds and sizes of electrical connectors on conductors, that improvement including the steps of: forming a first strip of connectors arranged in side-by-side disposition, each connector of the first strip including a ferrule portion, a contact portion, and an intermediate neck between said ferrule and said contact portions, said first strip having in addition to said connectors means connecting successive connectors to maintain their necks spaced apart, said first strip being characterized by uniformity in the linear distance from a point on the neck of a connector to a corresponding point on the neck of the next successive connector, independent of the size and shape of said connectors of said first strip, intermittently feeding the connectors of the first strip successively to a crimping point starting with the leading end connector of said first strip with a feed stroke equal to said uniform linear distance between corresponding points on the necks of successive connectors, crimping the connectors of the first strip onto conductors at said crimping point, forming a second strip of connectors arranged in side-by-side disposition, each connector of the second strip including a ferrule portion, a contact portion, and an intermediate neck between said ferrule and said contact portions, said second strip having in addition to said connectors means connecting successive connectors to maintain their necks spaced apart, said second strip being characterized by the same uniformity in the linear distance from a point on the neck of a connector to a corresponding point on the neck of the next successive connector, independent of the size and shape of the connectors of the second strip to adapt it for the same feed stroke as the first strip,

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the connectors of the second strip being characterized by having at least one of said portions of different dimensions than the corresponding portions of the first strip, intermittently feeding the connectors of the second strip successively to a crimping point starting with the leading end connector of said second strip with a feed stroke equal to said uniform linear distance between corresponding points on the necks of successive connectors, and crimping the connectors of the second strip onto conductors at said crimping point.

3. In the art of crimping various kinds and sizes of electrical connectors on conductors, that improvement including the steps of: forming a first strip of connectors arranged in side-by-side disposition, each connector of the first strip including a ferrule portion, a contact portion, and an intermediate neck between said ferrule and said contact portions, said first strip having in addition to said connectors means connecting successive connectors to maintain their necks spaced apart, said first strip being characterized by uniformity in the linear distance from a point on the neck of a connector to a corresponding point on the neck of the next successive connector, independent of the size and shape of said connectors of said first strip, intermittently feeding the connectors of the first strip successively to a crimping point starting with the leading end connector of said first strip with a feed stroke equal to said uniform linear distance between corresponding points on the necks of successive connectors, crimping the connectors of the first strip onto conductors at said crimping point, forming a second strip of connectors arranged in side-by-side disposition, each connector of the second strip including a ferrule portion, a contact portion, and an intermediate neck between said ferrule and said contact portions, said second strip having in addition to said connectors means connecting successive connectors to maintain their necks spaced apart, said second strip being characterized by the same uniformity in the linear distance from a point on the neck of a connector to a corresponding point on the neck of the next successive connector, independent of the size and shape of the connectors of the second strip to adapt it for the same feed stroke as the first strip, the connectors of the second strip being characterized by having said ferrule and said contact portions of different dimensions than the corresponding portions of the first strip, intermittently feeding the connectors of the second strip successively to a crimping point starting with the leading end connector of said second strip with a feed stroke equal to said uniform linear distance between corresponding points on the necks of successive connectors, and crimping the connectors of the second strip onto conductors at said crimping point.

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