May 5, 1964 W. A. WOLF 3,132,202

CLOSED END ELECTRICAL CONNECTOR

Filed Jan. 22, 1962

FIG. 1

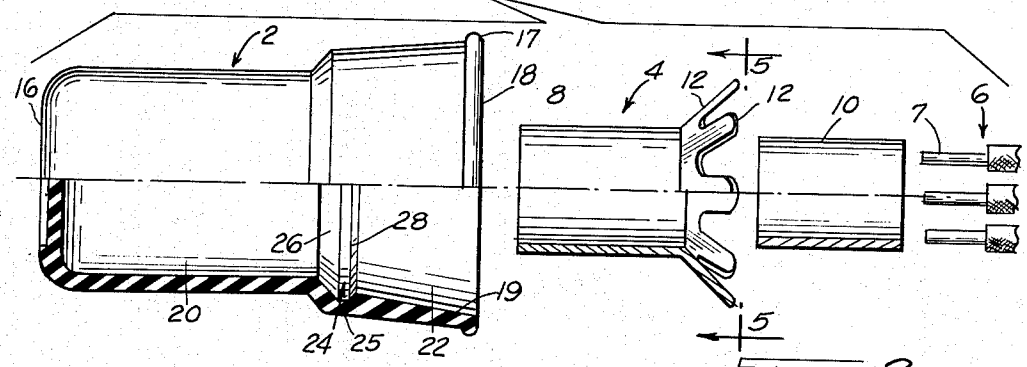


FIG. 2

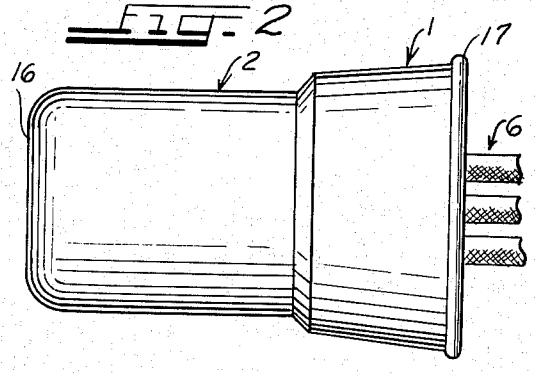


FIG. 3

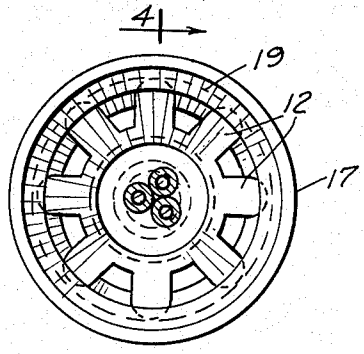


FIG. 4

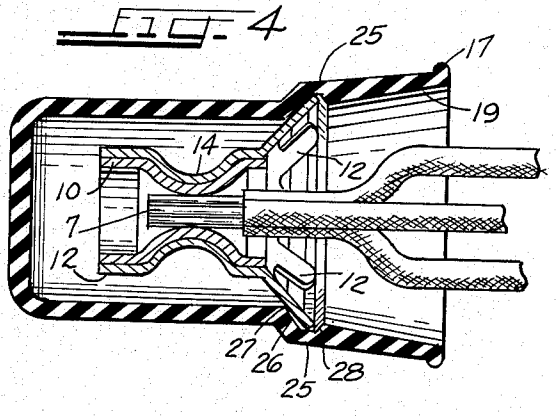
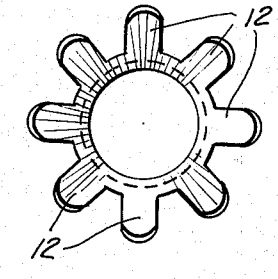


FIG. 5



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CLOSED END ELECTRICAL CONNECTOR

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This invention relates generally to electrical connectors, and more particularly to closed end connectors of the type comprising a snap-on cover for a crimping sleeve into which electrical conductors are inserted for joinder in an electrical and mechanical crimped connection.

The improved electrical connector constituting this invention comprises a two-part telescoping assembly of splice-cap means within insulating cover means, with a unique interconnection therebetween achieved by spring means integral with the splice cap projecting outwardly into an internal recess in the insulating cover such that the splice cap is held captive in the insulating cover with high conductor pull out and cover pull off characteristics. In a preferred embodiment, the insulating cover is made of a flexible material such that external pressure applied to the insulating cover unseats the outwardly projecting spring means of the splice cap from within the recess of the insulating cover in order to enable withdrawal of the splice cap from within the telescoping insulating cover. Likewise, a feature of the preferred arrangement is that the slope angle on the inside of the receiving recess in the insulating cover is somewhat steeper than the slope angle of the outwardly projecting spring means of the splice cap, whereby distortion of the spring elements is minimized when a user attempts to compress the composite assembly after the fingers have entered the retaining groove in order to effect the desired removal.

It has been known in the prior art to provide Snap-on covers for crimped joinder assemblies which utilize a spring interconnection, such as described in the Ustin Patent 2,870,239, issued January 20, 1959. However, a device of the type described therein comprises three separable parts, namely, a splice cap, an insulating cover, and a unitary spring clip which is received within the insulating cover independently of the splice cap. However, such a device was designed for and is operable by insertion of the splice cap into the insulating cover only in the direction toward the closed end of the insulating cover, as the spring elements of the retained clip flex inwardly and towards the closed end of the insulating cover. When removal of the splice cap in such a device is desired, as for deleting one of the various connections or for checking the connection of the crimped conductors, such a removal is accomplished by destroying the internal spring clip, since distortive force is required to dissassociate the crimped wire connector unit from the separate inwardly projecting spring elements.

Accordingly, it is an object of this invention to provide an improved closed end electrical connector assembly which has adequate cover pull off and conductor pull out characteristics, which is of simple construction, and which is readily and cheaply made with a minimum number of parts for manual assembly.

It is a further object of this invention to provide a retaining spring element in an outwardly projecting direction such that a minimum distortion of the spring element is evidenced and such that a ready disassembly and reutilization of the electrical connector may be effected.

These and other objects and advantages of the subject invention will hereinafter appear, and, for purposse of illustration, but not of limitation, an embodiment of

the invention is shown in the accompanying drawing, in which:

FIG. 1 is an exploded front view of the novel electrical connector, partly in section;

FIG. 2 is a plan view of the assembled connector shown in FIG. 1;

FIG. 3 is a side view from the right of FIG. 2;

FIG. 4 is a sectional view taken along the lines 4—4 of FIG. 3; and

FIG. 5 is a view similar to FIG. 3 showing only the tubular ferrule and its projecting spring finger elements.

With reference to the drawing, the novel closed end connector comprising the subject invention is generally indicated by the numeral 1. The connector 1 comprises the insulating cover 2 and the splice cap 4 which is telescopically received therein. Electrical conductors 6, which are suitably stripped at their ends 7, are inserted into the splice cap 4, which is crimped in a conventional manner as shown by the numeral 14 in FIG. 4 to retain the wires 6 within the splice cap 4.

In the preferred embodiment of the invention, the splice cap 4 comprises two telescoped tubular elements, the ferrule 8 and the sleeve 10, with the latter being received within the former. The outer tubular ferrule 8 is provided with coined outwardly projecting spring fingers 12 (eight are shown in the described embodiment), which project outwardly from the axis of the tubular ferrule 8 at an angle B as shown in FIG. 1. The tubular ferrule 8 is preferably formed from a thin seamless brass tube, such that coining and hardening of the spring fingers 12 may impart to those elements the desired spring characteristics. The inserted tube 10 is preferably formed from relatively heavy copper sleeve such that a reinforced crimped section 14 may be obtained to provide high conductor pull out strength without sacrificing the requisite degree of springiness in the elements 12.

The insulating cover 2 comprises a closed end 16 and an open end 18, a first tubular portion 20 adjacent the closed end 16, a second tubular portion 22 adjacent the open end 18, and an internal circumferential recess 24 disposed between the tubular portions 20 and 22. The insulating cover 2 is generally of uniform thickness except that an external flange 17 may be provided adjacent the open end 18 and an increased thickness portion may be provided at 25 in order to impart the desired strength characteristics to the cover 2. The internal recess 24 within the insulating cover 2 is defined by the rise 26 of the recess which is contiguous with the tubular portion 20 and the rise 28 of the recess which is contiguous with the tubular portion 22. The rise 26 is sloped at an angle with the axis of the insulating cover 2 (designated as angle A in FIG. 1) which, in the preferred embodiment of the invention, is greater than the aforementioned angle B, the angle of projection of the spring elements 12 from the axis of the tubular ferrule 8.

The internal diameter of the insulating cover 2 is greater than the external diameter of the tubular ferrule 8, and the respective diameters are so proportioned that the tubular ferrule 8 may be telescoped within the insulating cover 2 such that the outwardly projecting spring fingers 12 will be seated within the recess 24 of the insulating cover 2 in order to hold the ferrule 8 captive within the enveloping cover 2.

In operation, the ends 7 of the wires 6 are inserted within the tubular sleeve 10, and the tubular ferrule 8 is then inserted over the sleeve 10. A conventional crimping operation is then performed in order to effect a mechanical and electrical bond, as indicated at 14 in FIG. 4. This assembly, which constitutes the splice cap 4, is then forced into the interior of the insulating cover 2 via the open end 18 thereof. As the outwardly pro-

jecting spring fingers 12 come into contact with the inner surface 19 of the tubular portion 22, the fingers 12 are deflected radially inwardly toward the common axis of the tubular ferrule 8 and the insulating cover 2. When the splice cap 4 is inserted a sufficient distance within the insulating cover 2, the spring fingers 12 are positioned adjacent the continuous recess 24 within the cover 2 and then flex outwardly due to their inherent spring characteristics to be received within the groove 24. It should be apparent that a splice cap 4—insulating cover 2 composite so assembled will constitute the desired snap-on closed end connector. Moreover, splice cap 4 cannot be accidentally removed since the spring fingers 12 are retained within the groove 24 by virtue of abutment with the rise 26 thereof.

In the preferred embodiment of the invention, the insulating cover 2 is formed from a flexible material, such as nylon, such that external pressure may be applied at point 25 on the exterior of the insulating cover 2 in order to unseat the outwardly projecting spring fingers 12 of the ferrule 8 from within the recess 24 so as to enable withdrawal of the splice cap 4 from within the enveloping cover 2. Thus, when it is desired to remove one of the wires 6, to check the crimped connection, or to open the splice cap connection for any other reason, the simple manual application of pressure in the exterior of the cover 2 enables the splice cap assembly 4 to be withdrawn from within the cover 2. Obviously, the splice cap assembly 4 may be reinserted as desired, since the spring elements 12 are not distorted or destroyed in removal.

As a further feature of the invention, it has been found that when the angle A is slightly greater than the angle B such that the locus of tangency for the spring fingers 12 and the outer cover 2 is essentially the circle 27 which separates the tubular portion 20 from the rise 26 of the recess 24, a minimum of distortion of the spring fingers 12 is evidenced upon assembly and disassembly whereby reutilization of the composite elements is rendered more practicable.

It should be understood that various changes and modifications may be made in the details of construction, arrangements, operations, mode of assembly, and materials for the various elements, without departing from the spirit and the scope of the instant invention, especially as defined in the appended claims.

What is claimed is:

1. An electrical connector assembly for joining electrical conductors comprising:

splice cap means comprising a tubular ferrule having integral spring means projecting outwardly from one end thereof, said ferrule being adapted to be crimped onto electrical conductors to mechanically and electrically join the said conductors; and

readily removable insulating cover means comprising a flexible pressure-responsive tubular body having an open end and a closed end, an internal annular circumferentially continuous recess spaced intermediate said ends, said cover having an internal diameter greater than the external diameter of said tubular ferrule,

said tubular ferrule being adapted to telescope within said tubular body in a position to seat said spring means in said recess to hold said tubular ferrule freeably captive within said tubular body,

said tubular body being responsive to external radial pressure applied thereto adjacent said circumferentially continuous recess to bear against said spring means at a point removed from the free end of said spring means to unseat said outwardly projecting spring means of said tubular ferrule inwardly of said recess to enable withdrawal of said tubular ferrule from within the telescoping tubular body of said insulating cover.

2. A crimp cap-insulating cover closed end connector assembly for electrically and mechanically joining electrical conductors comprising:

a tubular ferrule having coined spring finger elements frusto-conically projecting outwardly therefrom;

an insulating cover comprising a flexible, pressure-responsive body having an open end and a closed end and comprising a first tubular portion adjacent the closed end, a second tubular portion adjacent the open end, and an internal circumferential recess disposed between said portions, the inside diameter of the insulating cover being greater than the external diameter of the tubular ferrule and the rise of the recess contiguous with the said first tubular portion defining an angle with the axis with the insulating cover which is greater than the angle of projection of the said spring finger elements from the tubular ferrule,

said tubular ferrule being adapted to telescope within said insulating cover in a position to seat said fingers in said recess to hold said tubular ferrule freeably captive within said insulating cover with a minimum of distortion to the said finger elements,

said cover being responsive to external radial pressure applied to said insulating cover adjacent said circumferential recess to press against said fingers at points removed from the free ends thereof to unseat said outwardly projecting spring finger elements of said tubular ferrule from within the recess of said insulating cover to enable withdrawal of said tubular ferrule from within the telescoping insulating cover.

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